PRACTICAL PRINTING

A HANDBOOK OF

THE ART OF TYPOGRAPHY

THE ORIGINAL WORK AND TWO FOLLOWING EDITIONS

BY JOHN SOUTHWARD

THE FIFTH EDITION

(EMBRACING THE WORK ON COLOUR PRINTING BY F. NOBLE)

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PRACTICAL PRINTING.

CHAPTER LXXVI.

Colour Printing.—The Theory and Practice of Chromatics.

Whoever would pursue the practice of colour printing with any intelligence must possess at least an elementary knowledge of the science of colours. This is especially the case with the three-colour printer, for without this knowledge he must work entirely in the dark, and can give no reason for what he does or for what is done for him by the producer of the blocks. In this chapter we shall endeavour to give just so much elementary instruction in the science as will enable the reader to understand why certain procedure produces definite results.

Colour, like flavour, is a sensation ; it is not even a quality, and it certainly has not a material existence. Its appreciation depends on light and the nerves of the retina. If the latter be disordered, the colours seen will differ materially from those seen by normal nerves ; while the quality and intensity of the light have a marked effect upon them.

There are several theories of the phenomena of light, but that which is now generally accepted is the wave theory. It is thought that light is due to vibrations or waves of ether, and that there are three sets of these vibrations of varying frequency. It is also thought that there are three kinds of optic nerves in the retina of the human eye corre-

because some parts of the original will reflect combinations of two or all three of the primary light-colours. If we now produce from these negatives three half-tone blocks by the Meisenbach process and print these successively one over the other with suitable pigments we shall produce a picture of the original in its own colouring.

This is the secret of the art of three-colour printing, an art largely due to the researches and practical discoveries of Mr. Ives of Philadelphia.

What now must be the colours of the pigments with which these three blocks are to be printed? A vermilion, a green, and a violet? Let us answer this question in the words of Mr. Zander in his lecture on the art, delivered at the St. Bride Institute and reported in the *Printers' Register* for June, 1899: "If we were to try to print them in red, green, and violet, the result would be disastrous from an artistic point of view. The reason is that in dealing with coloured light, we add one light on the top of another, and if the red, green, and violet are added in proper proportion they produce white. The printer in printing one colour on the top of another does just the converse—he subtracts from the white, and the more colours he prints on the top of each other the less is there left of white until we reach the negation of colour, *viz.*, black."

Hence the *primary pigment-colours* must be three colours, each combining two of the primary light-colours: that is to say, they must be a kind of *magenta* or *crimson* (a combination of the spectrum red and the spectrum violet), a *primrose-yellow* (a combination of the spectrum red and the spectrum green), and a *blue* (*cyan-blue*) which is a combination of the spectrum green and the spectrum violet. With these three pigments duly prepared, duly proportioned, and laid on in due sequence all colours and shades can be produced.

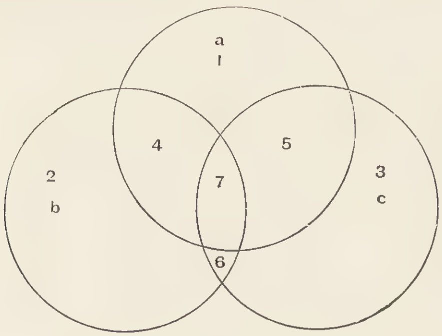
The Primary Colours.—We have now shown that the primary light colours, or spectrum colours as they are also

called, are red, green, and violet, or more particularly, vermilion, emerald-green, and blue-violet; while the primary pigment colours are red, yellow, and blue, or more particularly a kind of magenta-crimson, a primrose-yellow, and a cyan-blue.

Secondary Colours.—Secondary colours are the colours formed by the admixture or combination of two primary colours. It has already been shown that the primary pigment-colours are secondary light-colours. Secondary pigment-colours are:—

Green (a mixture of blue and yellow);
Orange (a mixture of red and yellow); and
Violet (a mixture of red and blue).

These secondary colours can be obtained not only by the admixture of the pigments named, but by superposition. If in the annexed diagram circle *a* be printed in primrose-



yellow, circle *b* be afterwards printed in magenta-crimson lake, and circle *c* in cyan-blue it will be found that where the colours overlap one another the secondary colours will be produced; that is to say, the space marked 4 will be orange, that marked 5 will be green, and that marked 6 will be violet. This can be proved by drawing similar circles and colouring them with water-colours.

Tertiary Colours are colours produced by the admixture or superposition of two secondary colours; such are:—

Citrine or citron (green mixed with orange);

Olive green (green mixed with purple); and

Russet (orange mixed with purple).

Complementary Colours.—It will be noticed that in the diagram there is a space, marked 7, in which all the three primary colours are printed. This space should be black, and will the more nearly approach to black the truer are the colours of the primary pigments, and the more intense they are; for if they allow any of the white of the paper to be reflected through them this central space will have a grey or neutral tint.

All the colours can, theoretically, be made to produce black when certain others are added to them, and these are called their complements. Thus red upon green, purple upon yellow, blue upon orange should give black, and these colours are called complementary to one another. We say theoretically they should give black, but they never do so in practice, because chemical science has not yet been able to produce pigments possessing all the qualities necessary in theory.

Tones, Tints, Hues, and Shades.—Besides different colours there are *tones* of colours, or different degrees of intensity. Thus, green may be varied from light to deep green, and blue, orange, etc., may be almost infinitely varied. By mixing colours with white, *tints* are obtained; by mixing colours with colours, *hues;* by mixing colours with black, *shades.* To recapitulate:—

Tones . .	Degrees of intensity.
Tints . .	Admixtures with white.
Hues . .	Admixtures with other colours.
Shades . .	Admixtures with black.

It is common enough to speak of hues and shades and of tones and tints as almost synonymous and interchangeable;

yet their respective meanings are distinct, and a confusion in the signification attached to them leads sometimes to very inconvenient mistakes.

Harmony of Colours.—Colours which are alike in quality but differ in tone—as a full Prussian blue or a deep green, and a tint of the same colour; and hues which are nearly allied—as brown and orange, pink and maroon—are said to harmonise.

Effect of One Colour on Another.—If you take a piece of red paper and look at it steadfastly for some time, and then look at a piece of white paper, a patch on the latter will appear as if it were coloured with *green ;* or if you place a red wafer on a sheet of white paper the same effect will be visible. Other colours in certain combinations give effects of the same kind, and the colours produced in this way are complementary.

Let us now consider the effect of black letters on coloured grounds. They obviously have a different effect from that presented when they are worked on white grounds. If the reader will investigate for himself he will find that—

1. Black ink upon red appears dark green.
2. Black ink upon orange appears bluish-black.
3. Black ink upon yellow appears black with a violet hue.
4. Black ink upon blue appears orange-grey.
5. Black ink upon green appears reddish-grey.
6. Black ink upon violet appears greenish-grey.

These may be verified by means of strips of tinted paper to represent lines, or by placing one piece of coloured paper upon another.

The printer, however, may not only use coloured paper for printing with black letters, but ground or "tint blocks." In these certain lines or patterns are sometimes formed, and enable brilliant effects to be produced. The juxtaposition of white always heightens the tone of the neighbouring colours, and renders them more brilliant than if one colour

were next to another, but the juxtaposition of black with any colour adds to its brilliancy or luminosity still more.

Contrast.—Colours, whether simple or compound, are said to contrast well with those colours which, if printed over them, would produce black or would approach to black. Having regard to this fact, it follows that when contrast is wanted, some colours may not be used together. For instance, for contrast—

Red and yellow	may be used	together, not	red and orange.
Red and blue	,,	,,	red and violet.
Yellow and red	,,	,,	yellow and orange.
Yellow and blue	,,	,,	yellow and green.
Blue and red	,,	,,	blue and violet.
Blue and yellow	,,	,,	blue and green.

In regard to the contrast of simple with secondary or compound colours, the following will be found to be practically useful, although it would be well were the student to work out the matter for himself:—

Red and violet accord better than blue and violet.

Yellow and orange accord better than red and orange.

Yellow and green accord better than blue and green.

The red, yellow, and blue should in these instances be of a lower tone than the secondary colours, violet, orange, and green.

The principles also enable us to lay down certain negative rules of the greatest importance to the printer. It has already been shown how two complementary colours when mixed give black. To prevent this result we must avoid certain combinations.

Therefore	*never print*	green	upon	deep rose	paper, or ground.
,,	,,	yellow	,,	violet	,,
,,	,,	violet	,,	yellow	,,
,,	,,	orange	,,	blue	,,
,,	,,	blue	,,	orange	,,

The student of colour printing would do well to get a

block, type-high, made of some hard, close-grained wood —say a boxwood block, such as is used by engravers. He should pull it in black on various coloured papers, to verify the preceding rules. He should then pull it in various coloured inks on white paper. Let him preserve these rough impressions, as they form useful memoranda for future reference, and are practical illustrations of chromatic principles.

To make the fullest use of these impressions he should then print on them various letters; but for convenience sake a camel's hair pencil and water-colours may be used instead of ordinary inks. Among other things he will find that black never produces a bad effect when associated with two luminous colours. When two colours accord badly, a black line will frequently restore the harmony, particularly if there is plenty of white between. The removal of the lines so as to leave a greater white space will generally restore the harmony.

Proceeding with the lessons to be learned from this ground-block, we may arrive at the following conclusions:—

Effect of Combination and Contrast.—*Deep Red* ground (or vermilion). Yellows are brightened, red lines between become deeper. Blue ink on this ground will be lower in tone than upon black, and will assume a greenish tint. Orange increases in brilliancy. Red, however, should not be used as a ground for gilt letters unless its tone approaches that of chocolate or "maroon." This latter colour is made by mixing red and black. The effect of a dark red-brown block printed on orange paper is very remarkable.

Yellow.—This colour may be got by using gold, or the ordinary yellow ink. If the ground is yellow, of course gold must not be employed. Blue (which accords so well with silver) takes a violet hue on a gilt or yellow ground. Green appears bluer and more pure; pinks and reds come out well. Violet is very pretty on a gold ground.

Green.—This ground is often used with gold, and has an excellent effect. A golden yellow line appears darker than on either white or black, and is much less brilliant than on a dark red ground. Blue looks dull on a green ground. Green, of a darker or lighter shade, looks subdued, but has an excellent effect. Red, pink, mauve, or violet all look well and brilliant. Yellow shaded or relieved with red has a peculiarly brilliant effect.

Blue.—Gold or yellow becomes more brilliant, the gold making the blue appear deeper. Yellow is intensified, as it becomes the complementary. Green becomes lighter and more yellow. Rose, lilac, and pink colours should not be used; they appear quite dead.

Violet.—Blue becomes greenish, green more yellow. Green, if of a yellow tone, becomes more brilliant, like orange. Bright metal gold shows up well.

Red-Brown.—On this ground all positive or primary colours stand out brilliantly.

Black.—Blue is lower by at least two tones; yellows appear redder; orange is finer and more brilliant; green is lighter; but rose colour and violet are well brought out.

These experiments will suggest a more frequent use of ground-blocks in printing; but the white and letters should be similar to those the printer has in his office. Indeed, it is an easy matter to pull an impression of a line and then trace it on to a block in the same manner as described for cutting odd wooden letters (Vol. I., p. 88).

CHAPTER LXXVII.

Colour Printing (*continued*).—How Colour Printing differs from Black and White Work—the various Aspects of the Subject—Necessity for studying Chromatics—Chevreul's Law of Simultaneous Contrast.

[This and the nine following chapters embrace the well-known work on Colour Printing of the late Mr. Frederick Noble, as revised by him in 1893-4, and now slightly edited. The style is rather more diffuse than that of the rest of this book, but it has been deemed best in the main to reproduce the writer's own language.]

The art of colour printing, compared from a practical point of view with that of black printing, is a much more complicated problem. The printer in black is dealing always with the same set of materials, namely, type or stereo formes and black ink; his conditions of working are simpler; they are less subject to variation; they are better understood. On the other hand, the colour printer is constantly dealing with conditions which are essentially different. His inks are made from twenty or thirty different substances, and many of them are largely subject to atmospheric influences. He has to print upon every kind of paper with every variety of surface. At one time he may have to use a soft, spongy paper; at another he may be required to print upon an enamelled card as hard as horn. The pigments of which his inks are made are many of them of recent invention; nor is their nature so well understood as those which are the basis of bookwork blacks. In colour

printing the conditions of the register are at once more complete and more exacting. The material upon which the blocks are cut also varies in character and changes in quality; the colour printer may have to print from wood, from zinc, from brass, from copper, or from soft metal; in printing register work from wood, he is never certain of his results; the wood is liable to warp, to contract, or to expand. In other cases, embarrassments of a chemical nature often present themselves. Not unfrequently it is found that an ink which will print well from one of these surfaces, prints but indifferently from another; thus, an ultramarine-blue ink which will print well from the wood, may be found to be an utter failure when attempted from a copper electrotype.

The various surfaces of enamel papers with which the colour printer has to deal afford illustrations of similar effects; an ink may be made which admirably suits one sort of enamel, but which, when tried upon another and different description, will be found not to work. The nature and qualities of our inks are therefore a matter of cardinal importance, and detailed instructions will be given for the combination of the various pigments with their appropriate varnishes so that they will form, under all circumstances and conditions, good, reliable printing inks, which will be brilliant in colour and durable in character, while they possess the attributes of working clearly and drying well. Such subjects as the preparation of original blocks, with an analysis of the various materials upon which they are cut, the making up of the formes, the methods of treatment in the making ready, the condition of the rollers, and the necessary modifications in the inks when intended to be used at machine, will also require attention.

There is, however, another and equally important phase of the subject, and that is the artistic one. It is necessary to know the principles of harmony in colours in their

application to practical colour printing. All colours reflect certain other colours, which are called the complementaries; thus, green gives off red rays and red gives off green rays; if the two colours are arranged side by side they give a contrast in which the greatest brilliancy is attained; in like manner purple, which is the complementary of yellow, when contrasted with that colour increases its vividness, whilst the yellow imparts additional strength and brilliancy to the purple. So, too, the Law of Simultaneous Contrast, that fundamental law in chromatics discovered by Chevreul, must be well learnt by the colour printer, for without a knowledge of it he is like a blind man groping in the dark, and will always experience difficulty in matching colours. This law of simultaneous contrast tells us how one colour contrasted with another not only modifies it, but in certain extreme cases totally changes its hue. Thus if we have a design of which the first working is a bright yellow, and the second working is intended to be a bright pink which falls contiguous to the yellow, we shall find that when we have pulled an impression of the pink block into the first working, the effect of the complementary of the yellow (which is purple) will be to convert the pale pink into a pale purple; the purity of the pink will be gone, and it will in fact be so far modified that it will look as if blue or purple had been used in its composition. Again, if we are given two colours to match, one apparently a pale lilac or mauve outlined with a strong yellow, we must not match the mauve tint as it appears to the eye, but, making allowance for the complementary, must print a pink instead, the purple rays from the yellow changing the pink tone and imparting to it its purplish hue.

Mons. Chevreul, in his great work, relates how he discovered this invaluable law. Some patterns representing a black ornament on a red ground were fabricated for a firm of merchants at Lyons, who returned them stating

that the ornaments were green and not black. This led Chevreul to investigate the matter, when he found, after careful experiment, that the complementary of the red ground had had the effect of destroying the purity of the black, and had imparted to it its greenish tone. This is a fact which any printer may verify for himself. Let him take a sheet of the scarlet-red surface paper sold by the stationers and pull in black ink a line of ten-line type upon it, or an impression from an auctioneer's broadside; when held up to the light the sheet will look as if it had been printed in a deep olive green. If he now takes a sheet of white paper, and cuts out a piece about a pica wide and lays it over one of the letters in the printed sheet, thus shutting out the red ground, the purity of the black will be restored, thus proving the green tone to be the effect of the complementary of the red.

CHAPTER LXXVIII.

Colour Printing (*continued*).—The Making of Inks—Varnishes—Driers—the various Pigments and their respective Qualities—the Rollers best suited to each.

The Making of Inks.—Having touched upon the principal topics which are to be discussed, we may now proceed to the subject-matter of our theme. In the first place, we propose to deal with the making of coloured inks, and the nature and use of the necessary ingredients, including all the pigments available. Printing ink consists in the main of varnish, into which a dry colour, finely pulverised, is rubbed until it refuses to hold any more. This is best done in small quantities on a marble slab, with a marble muller; in large quantities an ink mill, consisting of two iron or marble or granite cylinders grinding close to one another, and whose proximity can be regulated by one or more screws, is used.

Varnishes.—In the preparation of coloured inks three descriptions of varnish are commonly used. These are known in the trade as "strong," "middle," and "thin," according to their substance and body. When inks are required for very fine engravings or very small type, the most important qualifications they can possess are richness of body and an absence of clogging in the working. By grinding our inks in strong varnish, these conditions are best realised; the strong varnish has more affinity for the paper than it has for the forme; the pigment rarely separates from the varnish, and the forme is thoroughly

cleared at every impression. Strong varnish is, however, so stiff and dense in its nature that in mixing the colour great perseverance is necessary in order to get a sufficient quantity of the dry colour into it to give the ink the maximum amount of depth and body. If it be a colour requiring driers, they should be added after the ink is ground. If the pigment is pure, the ink, no matter what colour it may be, should be equal in depth and body to six-shilling black. Sometimes ink treated in this way will prove too stiff for distribution; the roller will not pick up the colour: when this happens it may be softened by the adding of a little thin varnish. Inks made wholly with strong varnish are more troublesome to deal with, involve greater labour on the part of the pressman, and require greater care and judgment than inks made with the thinner varnishes. But it is not possible by any other means to obtain such satisfactory results. We can never over-saturate strong varnish: with the thinner varnishes this frequently occurs, with the most deplorable results. If, for instance, we take carmine and treat as described above, we obtain the full force and brilliancy of this splendid pigment; if, on the other hand, in the mistaken idea of getting more body into the ink, we try a thinner varnish, we shall find that, although the thinner varnish has taken up a larger quantity of dry colour, there is no corresponding increase in its brilliancy; the varnish will be over-saturated, and a dull opacity will be the result. To recapitulate: in the finest hand press work, mix and grind stiff in strong varnish, and soften afterwards with just sufficient thin for the purpose if the ink be found too stiff for distribution; for show-card and high-class label work, mix in middle varnish; for use at machine, mix in middle varnish and lower with thin. When patent rollers are used for machine printing, and the ink is therefore required to be very soft, it may be necessary to mix the ink in thin varnish.

Driers.—Although it is a constant theme of complaint amongst colour printers that the inks they use do not dry well, yet, on a strict examination of the subject, it is often found that the cause of ink not drying may be as frequently attributed to abnormal conditions in the paper as to any defect in the quantity or quality of the driers themselves. In black inks, the difficulty of getting the ink to dry but rarely occurs. Black inks are often used for printing on damp paper, which, of course, facilitates the drying of the ink. In colour printing, dry rolled paper is almost universally used, and therein lies the difficulty. For coloured inks the following comprise all the driers within the writer's knowledge which are commonly used, and which have any real value: the acetate and oxide of lead, sulphate of zinc, gold size, and manganese, to the oxide of which umber owes its drying quality. There is another sort of driers which under certain circumstances, and especially in machine work, is of great value to the colour printer: this is the driers prepared by artists' colourmen for the use of artists in oil, and sold in collapsible tubes. Although the acetate and oxide of lead are largely used as driers in black ink making, for the purposes of the colour printer we may dismiss them in their crude state, if not as absolutely useless, at least as unnecessary. The principal objection to their use is that they have a tendency to make the ink pulverise when dry. Thus, if lead be used as a drier with either ultramarine or vermilion, there is a danger that the ink, when dry, may be wiped off in a dust. This so far simplifies the matter that it narrows our choice to two materials, namely, gold size and the driers mentioned above, which, for the sake of convenience, we will henceforth describe as tube driers. Both these may, and probably do, contain lead in some form or another: the gold size we know contains litharge, as well as asphaltum and manganese. The tube drier is a soft, thin, oily preparation, wholly destitute of bite or tenacity;

and in this respect it is in its external characteristics the direct opposite of gold size, which is very adhesive in character. These tube driers may therefore be used in cases where the employment of gold size would be inadmissible, because the strong adhesive quality it possesses would impart so much "lug" to the ink that it would cause the surface of any enamelled paper to break and peel off. The same remark may be applied with equal pertinency to any other weak paper used at machine; and even if the paper were sufficiently strong for the surface not to break on the forme, the sheet would probably break in the grippers if the forme were printed upon a single-cylinder machine, or would be pulled through the frisket if it were printed on a platen. In these and analogous cases the tube driers are a valuable adjunct to the resources of the printer; they are always reliable, and may be recommended with confidence for use in the machine room, where the inks must necessarily be soft and not possess too much tack. Gold size, on the other hand, is preferable for the best sort of colour work done at the hand press. In this description of work the object is to get the ink as solid and as rich as possible; this can only be done by having a large amount of body in the colour; it must be mixed and worked very stiff. The tube driers being of an oily nature would therefore tend to attenuate and weaken it; besides, at press the printer may help himself in a way which he cannot do at machine; he may, by carefully lifting his tympan, gently ease his sheet from the forme, whereas at machine he is bound by rigorous mechanical conditions. For machine work, drying oils are largely used in some colour houses; most of these are unsatisfactory in use; their drying qualities are not great; and although the best of them may have a certain value in very common work for easing or lowering the ink, they are in every respect inferior to the tube driers.

The general deductions to be drawn from the foregoing

are, that in machine printing, in attending to the drying of his inks, the printer must accommodate them to his machine —the inks must be made soft without too much tenacity, so that they may be easily distributed; at press the printer is under no such obligation—he has only to accommodate his ink to the requirements of his forme.

The pigments of which coloured inks are made differ largely in their drying properties. In assessing the quantity of driers to be used, this is a fact which must be borne in mind. Some colours are excellent driers in themselves, and do not require the addition of anything else to supplement their naturally powerful siccative qualities; others, on the contrary, dry badly under any circumstances. Amongst the former may be instanced Prussian blue, which, when simply mixed and ground in middle varnish, dries well on any sort of paper, not excepting enamelled or hard writing paper. Amongst the latter may be mentioned carmine and the whole tribe of colours which have cochineal for a basis; scarlet and crimson lakes and cochineal purples, the whole of which require the addition of liberal quantities of driers to ensure satisfactory results. Chromes, the mineral greens, ultramarine, and cobalt occupy an intermediate position between those colours, such as Prussian blue, umber, and sienna, which require no driers, and those others, such as carmine, which require a great deal. Tints which have flake white for a basis require no driers.

Driers require to be used with great discrimination; if an excessive quantity be put into some coloured inks they cause them to dry so rapidly on the rollers that their surface soon loses its freshness, and the ink is consequently not properly delivered to the forme. This is notably the case when using burnt umber or burnt sienna, either alone or as a basis of brown inks; these inks dry so powerfully by themselves that a moderately fresh roller may become dry on the surface and lose its grip of the slab in about half an hour after it is

first taken up. In printing a sienna tint this is especially noticeable, and requires careful watching. As the roller becomes dry, the ink is not properly delivered to the forme, or, in the technical language of colour printers, it is said not to furnish; the tint, therefore, instead of giving a flat, solid, even appearance to the forme, prints in patches, some parts of it taking the ink and others not doing so. In dealing with colours of this class it is an obvious mistake to add driers, although it is often done out of sheer ignorance. Inks of this character, when used for the hand press, should be mixed and ground in strong varnish alone, which, from its tenacious, sticky nature, will in a measure counteract the powerful drying properties of these inks, and assist in preserving the freshness of the roller. Another consequence of too much driers is that the ink does not clear, or only partially clears, the forme—that is, the dry colour of which the ink is made separates from the varnish and adheres to the forme, while the varnish only prints on the sheet; it follows, then, that an ink which contains too much driers will clog and fill up a type forme, and cause the fine lines of an engraving to look thick and dirty. This condition may always be determined by the state of the roller, which, when felt by the finger, offers no adhesion, and the finger slips along its surface as if it were a piece of dry leather. Whenever it is necessary to use these powerful drying colours a fresh new roller should be chosen, and its condition carefully watched; the moment that it shows signs of becoming dry on the surface, you may be sure that the quality of the printing is deteriorating, and the roller should be washed and sponged up.

When an exceptionally quick and powerful drier is required, equal parts of terebene and copal varnish may be mixed together, and a small quantity added to the ink. In dealing with the various pigments used in the preparation of printing inks more precise directions will be given on this important subject of driers.

White Ink.—A good white ink is difficult, if not impossible, to obtain, and yet it is constantly required by colour printers. The substance almost universally used for this purpose is an oxidised carbonate of lead, and is known to the trade as "flake white." It may be bought of any colour merchant at about 6d. per lb. Flake white has one radical defect—it oxidises on exposure to the air; therefore coloured inks made of it and exposed are liable to lose their brilliancy and purity. This is, no doubt, a serious defect, but, taking things as they are, this pigment is on the whole the best and almost the only one available for the printer. Other pigments have been tried, but they have all, for one reason or another, resulted in failure. Amongst the most successful, however, is zinc white, which possesses the inestimable advantage of being absolutely permanent in character, and in this respect is superior to flake white; but it is inferior to the latter in body, and when made into printing ink it does not cover well, which is an insuperable objection to its use.

In preparing a white ink for printing everything depends upon the most thorough cleanliness. If it be intended to make it in large quantities for use at machine, the flake white should be thoroughly pulverised in a large stone mortar, mixed stiff in the middle or thin varnish, and passed two or three times through a colour-grinding mill. It does not require much grinding, as it is an extremely soft pigment. It is not recommended to make a larger quantity of this ink than will be required for speedy use, as it rapidly skins and spoils. This ink may be reduced for the purposes of machine printing with thin varnish. No driers need be used with it.

It not unfrequently happens that the white ink forms the largest proportion of many pale coloured inks, and being from its nature very heavy, it separates from the varnish and does not clear the forme. When this occurs at press the printer may generally correct it by always grinding in

strong varnish, which holds the colour together and causes it to adhere to the paper. At machine, however, it is, as a rule, not possible to use strong varnish. We must therefore meet the difficulty in another way. A little white curd soap, perfectly dry, should be scraped in very fine shreds and thoroughly ground up with the colour. We are now speaking of inks which have white for their basis. It is necessary to caution the reader that it is not safe to use soap with all coloured inks, for the alkali it contains changes the character of some colours and militates against the drying of all. In colours which are compounded of flake white it may be used in small quantity with safety; it is not recommended as a constant ingredient of this ink, but as an expedient for removing a difficulty which frequently occurs with it. In using flake white ink at press the most satisfactory way of dealing with it for fine work is to grind it stiff in strong varnish and use it in that condition; but as this makes an ink which gives the pressman very hard work to distribute, especially if he is dealing with a large solid block, it may be desirable in this and similar cases to thin the ink, and if the colour does not clear the forme, a small quantity of soap — a piece the size of a Spanish nut to half a pound of ink—may be added.

This white ink is also the basis of all the body tints used in printing. Tints made with white are opaque colours, but this opacity depends upon the amount of white (or body) the tinted ink contains. If, for example, we wished to make a pale blue opaque tint—the blue inclining more to green than to purple—the white should be mixed very stiff and Chinese blue added; if we wished to preserve the same tone but required a semi-opaque effect, some varnish would be added to the first colour; if the same tone were required, but it was necessary that the tint should be a transparent one, the white would be omitted altogether and the colouring matter only mixed with the varnish.

The considerations which govern the question when we are to use white and when varnish for our tints must be determined by the character and incidence of the particular work to be dealt with. In certain circumstances white is indubitably beneficial; for instance, suppose we are dealing with a set of blocks which shall represent a design with a black background and a gold outline as a last working. We will assume, for the sake of argument, that the intermediate colours of the ornaments consist of two pale tints, a pale blue and a bright pink, and one positive colour, carmine. The tints in this case should be made with white. In the first place, there is no objection to an opaque colour, while it is an all-important consideration that the inks of which the tints are made should dry hard and dry quickly: this attribute white possesses—we are, therefore, right to use it.

When white is used as a body tint on some sorts of enamel it frequently exhibits the vices peculiar to lead driers—it powders, and the colour may be wiped off in a dust. The only way to deal with this is to use the strongest litho varnish, or, if it be admissible, change the body colour for a transparent one. The employment of soap in some of these cases will again assist us, and its use will be indicated when we are dealing with those colours which suffer no harm from its use. Having now exhibited the nature and peculiarities of white as a printing ink, we take leave of it until it is again required in considering the question of tints further on.

YELLOWS.—Amongst the large variety of yellow pigments which are available for the purposes of the painter and decorative artist, there are but few that possess any value for the colour printer. Indeed, it may be safely asserted that he might obtain every result he requires by using the various chromates of lead, either by themselves, modified by white, or toned by the admixture of other colours.

Chromes.—The best known and most useful of these

yellow colours are the primrose, medium, and orange chromes sold by most of the manufacturers at about 1s. per lb. Yellow inks are therefore very inexpensive.

Good chrome should be soft, not gritty; should break easily and feel smooth, but not damp, when rubbed between the finger and thumb. In preparing chrome yellows for printing, we must be governed by those general principles which apply to all other printing inks. If we have small type or fine engravings to print from, the pigments must be ground stiff in strong varnish, as affording the best chance of producing a clear working ink. For work which is not specially fine it may be ground in middle varnish; for machine printing, this may be softened by the addition of thin varnish, or it may be ground wholly in thin varnish. If required for printing on ordinary unsurfaced printing paper, no driers need be used, the chemical character of the pigment rendering them unnecessary.

Any of the tones of yellow chrome may be mixed with white in the production of tints, or with Chinese blue in the production of greens. Yellow chromes, in their full purity and strength, are too bright and vivid in colour to be used much by themselves in works having any pretension to refinement. In order to make them effective in any artistic combination into which they may enter, they are gently modified by white or some other colour calculated to deprive them of their obtrusive crudeness.

A good, firm, fleshy roller, but slightly damp, is the best for yellow chrome inks. Sometimes, when this pigment is not so good as it might be, and has been ground in thin or middle varnish, it is liable to clog. This must be obviated by the addition of strong varnish. Do not use soap.

Medium, or even lemon, chrome may be mixed with vermilion to produce orange colour. Medium chrome mixed with carmine produces a colour which Mr. Owen Jones used to call "gold colour"; or, mixed with Indian

red, it produces a yellow-brown, which makes a good printing ink.

The firm of Dr. Horace Cory & Co. have a very dense primrose chrome, which is quite unique in its character. In working it has the peculiarities of the best lakes, and with varnish makes beautiful transparent tints. This chrome may be known by the peculiarity of its texture; for when broken, instead of presenting the serrated appearance usual with chromes, it resembles Chinese blue or lake in its smoothness. It also has in certain circumstances a special value in gold printing. When using very soft under-sized enamelled papers, this primrose chrome is a valuable ingredient in the gold preparations required; it stands up on the face of the paper, resists absorption, and dries with a gloss. With a little of this chrome, ground in strong varnish and gold size added, no printer need be without the gold preparation which may be used upon an emergency for any description of gold printing.

For rich orange inks the deepest shades of orange chrome must be used; if those are not deep enough, vermilion or carmine may be added.

Chrome, when used for printing on hard cream laid or wove papers, sometimes dries with a gloss when this effect is not desired; at other times, when used on some surfaces of enamel, it is, like other pigments of the same chemical character, liable to powder. The first difficulty must be met by mixing the ink in thin varnish and using lead driers, which, by inducing a tendency to powder, will counteract the disposition to dry glossy. In the last case we must use the most tenacious varnish we can obtain, and supplement this with strong gold size.

Naples Yellow is a pigment occasionally used by the colour printer. It is less vivid and more modest in tone than any of the chrome yellows, and forms, without the addition of white, a pale, warm yellow tint of great purity

and beauty. In other words, it is a beautiful cool pigment of the buff character. It is an opaque colour, and possesses a good body. In mixing and grinding Naples yellow a marble slab is imperatively necessary, as the contact of iron soon destroys its colour. It prints and dries well, and is permanent in character. When made into printing ink it does not keep well, but frequently goes livery; consequently only small portions should be mixed at a time. As Naples yellow is much more costly than chrome and white, and a combination of these with a little carmine gives very nearly the precise tone of Naples yellow, the latter is only used—and that but rarely—for the finest sorts of work. Gold size may be added in small quantity for use on enamelled paper; for other sorts of paper no driers are necessary, unless the block used prints over other colours, in which case gold size must be used.

Yellow Lake is a pigment but little known outside the domain of the colour printer, but to him it has a distinct and unique value. Differing in its nature entirely from the chrome yellows, it possesses peculiar and valuable attributes which they do not possess. In its normal state, simply ground in varnish, it gives a pure yellow, lemon, or primrose tone of a perfectly transparent character, and it is this quality which gives it its peculiar value to the colour printer. When it is necessary to print a series of colour blocks, of which the first working is a yellow, any of the various shades of chrome may be used, because the key and subsequent workings falling on the top of the first working—*i.e.*, the chrome yellow—are not prejudiced by the opacity of the chrome. But if the exigencies of the work require that the key should be printed first, and the yellow and all other colours afterwards, then it becomes impossible, without a distinct loss of effect, to use any of the chrome yellows. Thus, supposing you have printed a key plate with a strong outline in black

ink, and you wish that this black outline should stand out in its purity and strength, you must not make your yellow of any of the opaque chromes, which would destroy the colour and sharpness of your key, but must use a transparent yellow, through which the black outline will show without any diminution of strength and sharpness. In yellows made from yellow lake we find these qualities realised.

There is another attribute of yellow lake which deserves noting. Unlike ordinary chromes, which dry flat and are more or less absorbed into the paper, yellow lake is one of those rare pigments which stand up on the paper and dry with a gloss. This qualification, in addition to its transparency, actually increases the force and strength of any key plate upon which it is printed. It must, however, be noted that by itself it dries badly; therefore, when used, liberal quantities of driers must be added. In using yellow lake where the lemon tone which is natural to it is required to be modified, care must be taken not to use an opaque colour. For instance, if we require a transparent yellow of a warm or orange tint, it would not be expedient to tone the colour with vermilion, which is an opaque colour, but to use one of the semi-transparent lakes instead. Thus, a transparent orange tint should be made with yellow lake toned to the required shade with pure scarlet lake. If a transparent yellow of a reddish-brown tone be required, the yellow lake may be toned with a little burnt sienna.

Yellow lake may be also used with advantage as the basis of delicate transparent greens. Mixed with a little Chinese blue, it gives a beautiful green, varying in tone according to the quantity of blue; while greens of an autumnal tone may be made by adding a little burnt sienna to the blue and yellow lake. This pigment may be bought of most of the large artists' colourmen. It is sold in pastilles of a cone shape, is very hard, and requires

a lot of grinding. It is also generally kept in stock by most of the large printing ink makers.

Cadmium is a colour which, though rarely used on account of its cost, is undoubtedly the grandest yellow pigment we have. It makes an ink which works well and covers evenly; while it is so bright and luminous that it makes the poor chromes hide their heads.

Ochres.—The various yellow ochres are not, as a rule, of much value to the colour printer, except in those cases where impure yellows of a brownish tone may be required.

Ochres, when ground in varnish, make printing inks which work well, dry rapidly, and are not fugitive in character. Iron is the basis of them all. Amongst them may be mentioned—brown ochre, which is very dark in colour; yellow ochre, which varies from a light warm to a brownish yellow; stone ochre and Oxford ochre, which are only varieties of the same pigment. In commerce these substances are scarcely ever used in the fabrication of printing inks, preparations of chrome, toned to the shade desired, being used instead thereof; for some effects in landscape printing the ochres have a distinct value, and are superior to chromes.

Roman ochre, which is deeper and richer in colour than those mentioned above, is the ochre most valuable to the printer, but it is only used for common work. It gives a yellow-brown, which may be used in the foregrounds of coloured subjects to exactly match the colour of a road or gravel. It may also be used with Chinese blue in the composition of brownish-greens for foliage; but this combination is inferior to that produced by chrome or mineral green and burnt sienna. Roman ochre is also useful reduced with varnish in forming warm yellow-brown tints. It dries well by itself. For work on enamelled paper add gold size.

REDS.—The number of red pigments available for printing

inks is very limited. The following comprise those which are in general use: carmine, crimson and scarlet lakes, vermilion, red and orange leads, the so-called magenta lakes, and rose pink. The three first-mentioned have cochineal for a basis; vermilion is made from mercury; red and orange lead speak for themselves; magenta is a wood or aniline lake, and rose pink is simply stained chalk.

Carmine is the most beautiful red pigment we have. Although very costly in comparison with other red pigments used by the printer, it stands unique in the vivid brilliancy of its colour. Carmine is made from the cochineal insect. The process of making it is a delicate one, and need not be further explained here than to say that the cochineal is dissolved by the agency of tin in large coppers, and when properly in solution is thrown down and the liquor—called lake liquor—drawn off. The residue, which is a crimson pulp, is then placed upon iron plates heated by steam, and evaporated to dryness. The product is pure carmine.

If the carmine has been skilfully prepared, it should only possess a moderate degree of hardness. For instance, when carmine has been over-dried, or too rapidly dried, it loses its rosy lustre, does not possess so much body as it should, breaks smooth like a lake, has a brownish-purple tinge, and is very hard. Carmine in this condition is useless for the production of that fiery red which carmine should give.

The great beauty of this pigment, and the large demand consequent thereon, has occasioned many spurious imitations to be made and thrown into the market. These adulterated carmines generally come from France, and closely resemble the fictitious diamonds for which that country is famed—they are very pretty to look at, but possess no real value. When carmine is adulterated it is generally with some farinaceous base, so that the inexperienced buyer may occasionally give as much as thirty or forty shillings for a pound of starch. In purchasing

carmine, however, the printer or ink maker may protect himself in two ways: he may test it with ammonia, in which, if pure, it should be perfectly soluble; or he may insist on having a small sample to make into printing ink before purchasing the bulk. The latter is by far the better plan.

Many of the French carmines are so lustrously beautiful in their dry state that even the best judges are liable to be deceived. When ground with varnish and made into printing ink their weakness is immediately apparent—in nine cases out of ten they possess no body; the ink made from them is devoid of colour. In purchasing carmine the best plan is to select some house of repute, such, for example, as Winsor & Newton, where you may be sure of obtaining the genuine article.

Carmine should give a red ink inclining to crimson rather than to scarlet, of great power, intensity, and purity. This it will do if the pigment be good in the first place, and adequate care be taken to secure this result in the second.

It is of cardinal importance in dealing with carmine—or, indeed, with any other delicate colour—that the slab, muller, and palette knife should be absolutely clean. If there is the slightest trace of black, the purity of the colour will be destroyed, and the red will acquire a brownish hue; while the smallest portion of blue left accidentally or negligently upon the slab will deprive the red of its vivid rosy hue, and cause it to incline to purple. The writer mentions these apparently self-evident facts with emphasis because he has found in a very large experience that pressmen do not always realise the great importance of thorough cleanliness in dealing with colours.

Assuming, then, that we have pure colour and clean slab, muller, and knife, the ink-making process may begin. We will suppose that we have to make a small quantity of ink to print a very fine wood-cut, and that we wish to obtain the maximum of effect and brilliancy with the indispensable

qualifications of working clean without clogging or filling the forme up. To this end we take two ounces of dry carmine and pulverise it in a mortar or by rubbing it with the muller on the slab; then taking some of the strong varnish technically known as "long varnish," the powdered pigment must be rubbed into it, or mixed with a palette knife until the varnish refuses to take up any more colour. This must then be well ground with a stone muller—a wooden brayer is useless—by rubbing the colour over the slab until it is perfectly smooth. This should be done at least twice. If these directions are faithfully carried out, you will have produced a $\frac{1}{4}$ lb. of carmine ink possessing every attribute (but one) valuable to the printer. It will be rich in depth of colour and brilliant in tone; and if it be ground well, it will work a page of diamond as clearly and sharply as the highest-priced black of the best ink makers. The only quality it lacks is the capacity for drying.

Carmine made into printing ink is a bad drier. Gold size must therefore be added—less than $\frac{1}{4}$ oz. will do, if the work is to be printed on soft absorbent paper; if the paper, however, be hard, a little over $\frac{1}{4}$ oz. must be added. If it is intended to use enamelled paper, the gold size should be mixed with the strong varnish in the proportion of one to five, and the pigment ground up in this. A moderately fresh fleshy roller is the one best suited for carmine.

It must be borne in mind that the experimental piece of ink we have made is intended to be equal to the best that can be bought for money. It is therefore very stiff. If a cheaper and poorer colour will suit the purpose, it may be reduced by adding more of either strong or middle varnish, which may deprive it of some of its velvety richness, but will not destroy that beauty for which carmine is unrivalled.

In making up carmine in large quantities, an ink mill will be found necessary. In this case the dry colour is generally

crushed in a large mortar and the varnish added. If the ink is intended to be used at machine, it will not be necessary to use strong varnish, which would possess too much bite and tenacity for that class of work; but the pigment must be well ground in a thinnish middle varnish, and the driers added afterwards.

Carmine ink, when made from a pure pigment, is not one which gives much trouble to the printer. Sometimes, however, in damp weather, when the roller is very fresh, it may betray a tendency to wipe. To avoid this the forme will require skilful and careful rolling, and it may sometimes be necessary to add thin varnish to prevent the wiping. We are now speaking of the ink which has been mixed with strong varnish alone. This, however, is the only fault which can be fairly charged against carmine, and it is one which a little experience in its management will soon enable the tyro to control.

Carmine may be used with white in the production of pink; with blue and white in the production of mauves and lavenders; with black in the production of rich maroon browns. Suppose, for example, we require a very delicate pink tint, such as we should see in the palest tone of a rose leaf. For this we take some of the white ink, as already described, and mix with it a very small quantity of pure carmine ink until the required shade is produced, and so on with any deeper tones. If a little ultramarine or cobalt be added, we get a mauve or lavender ink, inclining either to red or blue, according as the blue pigment or the carmine predominates.

A very rich chocolate brown ink may be made by adding a little black and Chinese blue to a pure carmine ink. This brown is unique for richness, but it is very costly—almost as dear as the carmine itself. It must also be remembered that, in comparison with other browns, it is a bad drier; it is not, therefore, recommended, except in those cases where

the question of cost is of secondary consideration. In the absence of purple lake, carmine may be used with ultramarine in the production of purple inks, but the results are inferior to the best specimens of purple lake. Pink tints may also be made of carmine and varnish, instead of white, in which case the carmine is simply added to the strong varnish, care being taken, however, not to forget the driers. In cases where it is required to produce a more scarlet tone than pure carmine possesses, vermilion or red lead in small quantity may be added. If the latter, the quantity added must be small indeed, or the ink will go leathery before it can be used.

Before quitting this subject there is one more observation to make, which, although applicable to all colours, is emphatically so in the case of carmine. No matter what may be the intrinsic merit of the colour itself, if too much colour be crammed into the varnish the ink is spoilt—its lustrous beauty and brightness will be destroyed. Carmine, however, unlike vermilion and many other pigments, but rarely separates from the varnish. The consequence of overloading is therefore seen in the diminished brilliancy of the ink when printed. It must be remembered that this effect only occurs when thin varnishes are used in mixing it; when strong varnish alone is used, it is a physical impossibility.

Although carmines are sold at all manner of prices, a thoroughly good one cannot be bought for less than 50s. per lb. It is false economy to purchase the cheap carmines, which are generally worthless; it is a very light pigment, and a little goes a long way. With one word of caution we take leave of this colour—if it is found to corrode on the slab or the roller feels gritty, it is a sign that the pigment is adulterated, or that it is not properly ground. Good, well-ground carmine ink should work as smooth and clean as the best black.

Vermilion is a bright red pigment of remarkable body,

and is found in its natural state in China. This natural Chinese vermilion, which is of a deep, rich crimson tone, was the only one used by the early painters. Artificial vermilions are now made that do not differ chemically from the natural ones. Vermilion is a sulphuret of mercury, and as this combines chemically with copper, vermilion red must not be used with an ordinary electrotype plate. To the printer it is a most valuable pigment, and is the basis of most of the red inks of commerce.

Vermilion is a much softer colour than carmine, and consequently does not require nearly so much grinding. When the varnish with which vermilion is mixed is much overloaded with colour, it invariably separates, leaving the pigment on the forme; and in this respect it offers a distinct contrast to carmine. When this occurs it may be at once seen by the impoverished appearance of the printed impression; the printer has only to look at his block and he will see the colour lying thereon in hard, dry masses. No satisfactory printing can ever be done while the ink is in this condition. The way to remedy it is to add strong varnish or dry curd soap, taking care in using the latter that a little gold size be added at the same time, so as to correct the non-drying quality of the soap.

The writer remembers a very striking illustration of this tendency of vermilion to separate from the varnish, in the printing of the fourpenny postage stamp, which he was then superintending. On scrutinising the work which this plate was yielding, it was found that, instead of the colour printing firm, solid, and bright, as vermilion should do under normal conditions, the men were only printing a stained varnish. Suspecting the cause, *viz.*, that the pigment was precipitating, an examination of the forme showed that the vermilion had accumulated on the small white letter tablets containing the value, to the depth of nearly a thick lead, and might be scraped off with the nail.

Vermilion is made in every gradation of tone from a bright orange to a deep crimson. It may be mixed with black in the production of browns; mixed with brown or medium chrome it gives a bright orange; reduced with white or varnish it may be used for salmon or flesh tints. Of the latter it may be said that the flesh tints of vermilion are very delicate and pure; used alone it would not represent the flesh tint of a brunette. This tone must be obtained by the addition to the vermilion of burnt sienna; and, if it be necessary to imitate the tawny hue of the sunny south, lake and umber must supplement the sienna and vermilion until the tone desired be arrived at.

There is another observation—and a very important one—to make with regard to vermilion before this subject is closed. There is no colour in the whole range of printing inks which is so dependent upon the condition of the rollers for the development of its full beauty as is vermilion; and this observation holds good whether we are dealing with press or machine work. The rollers must not be damp. With the very best red that was ever made it is impossible to produce a bright colour if the roller or rollers be too fresh.

This is a difficulty which is often experienced by machine printers trained in book houses, and who have consequently but little opportunity of becoming acquainted with the habits and peculiarities of coloured inks. The machine-minder, in commencing a job in vermilion red, probably (if experience has not already corrected his notions) treats his rollers as if he were going to print a job in black ink, *i.e.*, he sponges them in water and puts them in fresh. When he has run his waste and got a sheet through, he finds that the ink, instead of printing a bright red, shows on the paper as a dirty reddish-brown. The same effect takes place in press work.

Assuming that everything has been made thoroughly clean in washing up, the printer need not look further for the

cause of this than the condition of his rollers. On examining them he will find that the body of the ink has been left behind on the slab, and that the rollers have only picked up a stained varnish. In this case the rollers should be taken out, washed up in turps, and allowed to get tolerably dry, but not skinny. If they are then put in, the ink will be found to print in all its intrinsic brightness.

It follows, therefore, that in dealing with vermilion red the printer cannot avail himself of sharp rollers when this quality is dependent upon the moisture imparted to their surface by sponging. When he has anything to print in vermilion red, such, for instance, as small type, which, if it were printed in black, would require a sharp, fresh roller, he must get over the difficulty by careful attention to the preparation and condition of the ink, which must not be too thin, and by the choice of good, new, fleshy rollers.

When rollers are in proper condition for printing vermilion reds, their surface should at once be covered with the full depth of colour—the ink should appear as bright on the face of the roller as it does in the can. If it imperfectly covers the rollers, it shows that the ink thereon is transparent from the absence of body or colouring matter, and this is an evidence that the rollers are too damp.

Two leading principles—applied to vermilion reds—may be deduced from the foregoing, and they may be said to govern the whole subject. The first is to get the roller or rollers covered with the full strength of the ink; and the second is to get every particle of the ink off the forme on to the paper when the impression is pulled. The former is dependent on the condition of the rollers, and the latter on the preparation of the ink.

Sometimes it may be desirable to have a richer and brighter red than vermilion alone is capable of producing. When this is wished, a small quantity of carmine may be ground up with it; or, if this be considered too costly, a

little good scarlet or crimson lake may be made to answer the same purpose.

To recapitulate: for very fine engravings or very small type, mix as stiff as possible in strong varnish; for a good rich red suitable for any of the purposes of first-rate commercial work, mix moderately stiff in middle varnish—an ink of this sort will do for titles when printed alternately in red and black, for the rules round the black text of a book, or for show-card printing; for machine printing, mix in middle varnish and reduce with thin; if required for enamelled papers, mix in middle varnish, add tube driers, and lower with thin varnish if found too stiff. If for enamelled work at press, mix in strong varnish, add gold size; if found too stiff, a little thin may be added. When printing block work, see that the forme is cleared at every impression; if any of the colour is accumulating, the ink requires modifying. Vermilion red prints best from wood or brass; if it be required to use electrotypes, they should be silver or brass faced, as the ink turns black when printed from copper.

Scarlet and Crimson Lakes.—Like carmine, scarlet and crimson lakes are made from cochineal, and although they possess some of the characteristics of carmine, they are more transparent in character, are harder and more difficult to grind, do not contain so much body, and are destitute of that richness and intensity which are peculiar to carmine. Nevertheless, under certain circumstances, they are valuable colours to the printer. They are a possible substitute for carmine when bright transparent reds of a crimson tone are required.

Some very beautiful lakes of a rich crimson colour have of late years been imported into England from Germany. These contain almost as much body and density as carmine itself, but they are more purple in tone. These lakes may be used in colour work where bright scarlet or crimson tones

are required of a transparent character. If, for example, the subject we are dealing with were of a military character, in which it was necessary to exhibit a large number of uniforms—amongst them blue, scarlet, and purple—scarlet lake would be the most appropriate pigment to use, as it would suit exactly for the scarlet coats; while, if it were made to fall over a blue, its transparent character would, with the blue, give an excellent purple. Vermilion would not suit nearly so well for the same purpose, and carmine reduced with varnish to make it transparent would even then be more costly.

Lakes may also be used, reduced with varnish, or amalgamated with white, in the production of pink tints; but they rarely in this respect yield such good results as carmine, and they never give such bright, pure pinks as do the best carmines. Like the tints of carmine, those made with lake are extremely fugitive, and rapidly fade on exposure to light and air. In making lakes into printing inks it is best to grind them in middle varnish. They are, as a rule, very hard colours, and require plenty of grinding. As lakes dry badly, a liberal quantity of driers should be used; the proportion indicated for carmine applies also to them. In making up lake inks it is not recommended to make up large quantities at a time, as they go tough and livery. Scarlet lake is valuable as an addendum to vermilion reds; it may be also used with advantage to give richness to browns of which umber is the basis, and it is also used in the production of transparent warm greys; in the absence of purple lake, it may be used with cobalt in the production of mauves and lavenders.

When pure and well ground, these colours offer no peculiarities calling for special remark. If, when made up into ink, they are found to lack brilliancy, it may be assumed that the pigment is deficient in quality, and others may be obtained. If the ink goes livery, a little thin varnish should

be added to soften it. This should be well rubbed into the ink with the muller. A moderately fresh roller should be used.

Red Aniline Lakes.—Of late years a large variety of bright red pigments have come into use. These may be roughly divided into two sections, *viz.*, those which incline to crimson may be described as magenta lakes; while those which tend more to scarlet are called geranium lakes. They have the same aniline basis, and the differences in tone have been the result of technical improvements, during the past few years, in the methods of manufacture.

Magenta Lake.—This pigment is now largely used as a substitute for the more expensive lakes made from cochineal, and even for carmine itself. Although it does not possess the fire and brilliancy of the latter, it is superior in body to average scarlet and crimson lakes; it is also more crimson in tone than they are. When mixed very stiff it produces a crimson ink of great richness, which is nearly as permanent as that obtained from carmine. Mixed with vermilion in the proportion of three of the latter to one of magenta, it gives a rich, bright red inclining to crimson, which may be used to print from almost anything except copper electrotypes.

In combination with burnt umber it produces a rich, warm brown, which dries well without the addition of other driers; amalgamated with black, it yields a fine chocolate colour but little inferior in richness to that produced with carmine and black; with flake white or varnish it produces good pink tints, which, although they are less pure than those given by carmine, may be found acceptable in common work where a slightly purplish tone would not be objected to, and where a cheap ink is desired.

Magenta may be bought of most of the large colour merchants at from four to six shillings a lb. When using it for enamelled papers, gold size equal to one-eighth of the

varnish used in mixing it should be added; if required for use at machine or for weak enamelled paper, the tube driers may be substituted. As a rule, this colour makes a printing ink which works well; nor does it offer any peculiarities calling for special remark. A good firm roller, not too fresh, is most suitable. Magenta is a comparatively soft colour, and may be ground easily with the muller.

Geranium Lake.—There is now in the market a large variety of very brilliant scarlet lakes made from aniline. Almost everything which has been written about the magenta lake applies to the geranium. It is, however, a very dangerous pigment to use in work where any degree of permanency is required. The writer has known cases where, from inadvertence or ignorance, this colour has been made the basis of the flesh tones used in a coloured portrait, with the result that in less than a year after the printing was done the flesh tones had all vanished. With this word of warning we take leave of geranium lake and address ourselves to another colour which has all the advantages which geranium lacks.

Madder Lake.—This pigment in its natural state has been for many years the only one upon which the printer or painter could rely to give him fairly permanent tones for his flesh tints. In its dry state it is a beautiful bright pure pink, which retains its purity and beauty when mixed with varnish and made into printing ink. Except, however, for the very highest class of work its great cost was prohibitive, the dry colour costing from 60s. to 120s. per lb. It was felt by some eminent French chemists who were identified with a large printing ink manufactory in France, that this expense was a blemish science ought to be able to remove. Their efforts have been met with unqualified success, and imitation madder lakes may now be bought in the London market from about 6s. per lb. These imitation madders have, in one respect, a distinct advantage over the real ones,

for they are made in several depths of tone. The worst quality they possess is one which they share with the real madder, *i.e.*, they all dry badly, and this is a fact which must be borne constantly in mind.

Red Lead.—Although this colour does not possess much value for the colour printer, there are a few cases in which its use is desirable. As a body colour it is an impracticable pigment, as it sets hard when made into printing ink. It may, however, be mixed in small quantities with carmine to give the latter a more scarlet tone and to assist its drying: this is done as a rule in a very large house of which the writer had an intimate acquaintance. The chief value, however, of red lead is its adaptability for producing, with varnish alone, pure orange tints. This colour must not be mixed with flake white, in combination with which it rapidly blackens on exposure to the air. In tint with varnish it gives a pale reddish-orange, which cannot be matched by any other means. No driers are required, and only a small quantity of the ink should be placed on the slab at a time.

This closes the analysis of red pigments, with the exception of *rose pink*, and it is only necessary to observe with regard to this, that it is useless for the finer sorts of printing inks, and it is only used for the commonest posters and the cheapest varieties of fancy papers.

PURPLES.—For many years after colour printing had attained considerable development, there was no purple pigment suitable for the manufacture of printing ink. There were, indeed, the purple lakes made from cochineal; but these were often brownish in tone and always deficient in body, besides being very expensive. Consequently, when a purple ink of good body was required, it was generally composed of cobalt and carmine, or of carmine and ultramarine, when the latter colour had been so far improved as to be capable of producing good working ink. These combinations yield purple inks of good body, but they do

not possess the lustre obtained by using the purple pigments which have been brought into use during the past twenty years.

Although these purple colours are a great improvement on the old amalgamated ones, they can by no means be regarded as perfect pigments; although possessing good body, they are deficient in depth and intensity, and invariably dry badly. Like the magenta of which we have already treated, they are sold in large irregularly-shaped lumps at from 4s. to 6s. a lb., and may be bought of most of the wholesale colour merchants. Those of recent make are also sold in small cones.

Purples are made in two tones, red and blue. In using these, it frequently happens that the blue shade is not sufficiently pronounced for the purpose, and the red shade is not red enough. In the first case, ultramarine of the finest quality may be added; in the second, carmine, magenta, or crimson lake should be added. Red purple lake and carmine give a beautiful red violet of great force and brilliancy.

In working, these purples possess many of the peculiarities of cochineal lakes—they are liable to go livery; therefore it is best to make them into printing inks in such quantities only as are required for immediate use. The tone of any of these colours, either used alone or modified with ultramarine or carmine, may be lightened by admixture with the white ink which has already been dealt with, and in this case no driers are required. Used by themselves, or with carmine or ultramarine, a quantity equal to one-sixth of the varnish used in making the ink should be added. If the work is not intended to be rolled, or if the paper be damped, a lesser quantity will suffice.

In dealing with these purple lakes, inasmuch as they are naturally deficient in depth of colour, the ink made therefrom must be mixed very stiff where great intensity of

colour is desired. Rollers, therefore, which are fresh, damp, or too soft must be avoided. In printing solid tablets or white letter blocks, a very firm roller but slightly damped on the surface is the best; if the roller be too new or too fresh, it will not pick up the ink. Sometimes, owing to atmospheric conditions, it is not always possible to get rollers precisely suited for the purpose; in these cases the ink must be modified, so as to suit the roller, and may be softened by the addition of a little thin varnish, taking care that too much be not added, or it will operate against the drying of the ink.

BLUES.—Notwithstanding the number and variety of blue pigments which are available for artistic purposes, there are very few indeed suitable for those of the colour printer. When we have enumerated Prussian blue, ultramarine, cobalt, and Antwerp blues, the list is exhausted; and although it is a numerically weak one, what it lacks in quantity is made up in quality. These colours are all really valuable and useful ones, and by their means any tone or shade of blue printing ink may be produced. Foremost in utility, if not pre-eminent in beauty, stands

Prussian Blue (or Chinese Blue).—In its chemical composition, Prussian blue or Chinese blue, the name by which it is most generally known in the trade, is a cyanide of iron. It is a very powerful dense blue pigment, which, when broken, exhibits a beautiful copper-bronze colour; and it is from this that the name bronze blue is derived. As a colour adapted for the manufacture of printing ink, it has every attribute which can commend it to the colour printer. It possesses remarkable depth of colour, always works sharp and clear, and is in itself a powerful drier.

The very beautiful copper-hued blue ink known as *bronze blue* is made from this colour ground in pure copper-plate oil. Any admixture of an ordinary letterpress or lithographic varnish destroys the bronze effect, except it be printed on

unfinished enamel paper, *i.e.*, on paper which has neither been brushed nor milled—in this case, even if the colour be mixed with ordinary varnish, the ink dries with the copper hue.

In making ordinary *Chinese blue* ink the colour must be thoroughly pulverised, mixed in strong or middle varnish, and thoroughly ground. It is a very hard pigment, and in order to get it quite smooth it requires an immense amount of grinding. Very small quantities may be ground by hand with the muller, but for large quantities an ink mill is indispensable.

Chinese blue may be mixed with inferior or impoverished blacks with the certainty of improving them; on account of its great body and strong drying properties it is eminently suited for mixing with black ink intended for printing on enamel papers. When mixed with ultramarine, in the proportion of one part Chinese to three parts ultramarine, it has the effect of considerably deepening the latter colour and of improving its working qualities. It must, however, be confessed that this is not done without sacrificing some of the luminous brilliancy of the former blue. When mixed with flake white it gives bright blues, inclining more to green than to purple, which preserve their purity in artificial light, and this is what blues compounded from ultramarine do not do. With varnish alone it gives pure blue tints, which, although not absolutely permanent, are much less fugitive than those produced by carmine lake or purple.

Chinese blue may be also used with chrome in the production of almost any shade of green, although the results given by these chrome greens are inferior to those obtained with the best drop green lakes.

A firm, moderately fresh roller is the best suited for this colour, although a fair pressman may get good results with it under almost any conditions of temperature and weather, even when the rollers are dry and soft as in summer, or

hard and damp as in winter. In this respect it offers a marked contrast to vermilion, for which the rollers must be in a certain condition to yield even respectable results. It is not recommended to make very large quantities of this ink at once unless it is intended for immediate use, as it dries so rapidly that it soon skins and spoils.

As a rule this colour requires no driers, but if this blue is used for one working of a set of colour formes, of which the last one is gold bronze, a little gold size may be added.

To summarise: For bronze blue, grind in copper-plate oil; for very dense blue, which prints almost as deep as black, grind very stiff in middle varnish; for bright light blues, add small quantities of the blue to white ink until the required shade is attained. A modification of the latter may be obtained by adding ultramarine to the Chinese and white, and this gives a bright light blue partaking of the ultramarine character. Alkalies destroy the bronze effect of this colour; therefore, do not use soap. The chief thing to note in dealing with it is to see that it is well ground. The price of the dry colour is from 2s. to 3s. per lb.

Ultramarine. — Pure ultramarine is prepared from a stone called the "lapis lazuli," which is found in the East. It is at once the most brilliant, the most permanent, and the most costly of all the blue pigments. It cannot, however, be made into printing ink, and having paid this tribute to its beauty, we will dismiss it and turn our attention to the fictitious ultramarines which have of late years been largely adopted for printing purposes.

The first attempts of the colour makers to produce a fictitious ultramarine which might be converted into printing ink were not crowned with success, but step by step the artificial colour has been improved by slow degrees, so that a fair measure of success may be reasonably expected if caution and judgment are used in the selection of the colour,

It must, however, be admitted that notwithstanding the great improvements which have taken place in its manufacture during the past twenty years, it still remains the most obstinate and troublesome colour with which the ink maker and printer have to deal.

Fictitious ultramarine is made in many shades and various qualities, and the price varies from 1s. to 5s. per lb. The only certain method of testing the quality of this pigment is to get a sample before ordering the bulk, and make it into ink by grinding it in middle varnish. If, when an impression is pulled, it exhibits good body and colour and clears the forme well, it may be taken for granted that the colour is all right.

In dealing with ultramarine for machine work, it should be mixed in thin midde varnish, and a little oil driers added. For really good hand press work it must be mixed very stiff in strong varnish, and a little gold size added if it be intended for printing on ordinary printing paper; for enamelled papers a larger quantity will be necessary.

As the character and quality of this pigment vary very greatly, it will be worth while for the consumer to take some trouble to discover those sources whence the most reliable colours may be obtained. Some of the best ultramarines come from Germany, and the most satisfactory which the writer has tried are those of Herr Spuger and Herr Steinoff; the latter was used by De la Rue. It is not economical to buy cheap ultramarine; for the loss of time thereby occasioned will more than absorb any difference in the cost between the cheapest and the dearest.

The main difficulty which the printer has to contend with in dealing with ultramarine is its disposition to work granular or motley; it is difficult to make it look flat and solid; it is liable to print in patches, a consequence of its not properly clearing the forme, and it does not furnish well. This last-named peculiarity receives very forcible illustration

when we endeavour to print the full strength of this colour on enamelled paper.

Suppose, for instance, that we have a white letter block cut in wood, zinc, or soft metal to print in full ultramarine: the block may represent the first working of a show card, of which the second working would be the black shading to the lettering. We will assume, further, that half the quantity is to be printed on ordinary commercial cards and half on enamelled boards. As the block contains no line work to fill up, it will not be necessary, at all events with the plain boards, to grind the ultramarine in strong varnish; it may therefore be ground in middle varnish. If great depth be wanted the ink must be mixed stiff. When the forme is ready, we require to choose a roller which will suit alike the ink and the forme, *i.e.*, we want that sort of roller which will take up readily a large body of colour, and distribute it with facility both on the slab and on the forme. A little consideration will convince us that we do not want a sharp, damp roller. We do not want a sharp roller, because there is nothing in the forme to keep clean; we do not want a damp roller, because, the forme being a solid one, we wish to get the colour as full and as rich as possible; and the effect of dampness in a roller is to prevent it taking up the full strength of most printing inks. The roller, therefore, which will best suit our purpose for this forme will be a very firm and well-matured one, but very slightly sponged on the face. This will be sure to take up and deliver to the forme as much colour as will give a satisfactory result in point of richness and depth, provided only that when the impression is pulled, the ink has properly cleared the forme.

Assuming that this is so with respect to the plain boards, they are printed off and an impression in the same ink is taken on one of the enamelled ones. In this case it is by no means unlikely that the whole mass of dry colour will separate from the varnish and be left on the forme, a blue

stain only printing on the paper. This is by no means an uncommon freak of ultramarine. When used for printing on enamelled papers, it is governed in a great measure by the method of preparing the enamelled surface for printing. In the present instance, the ink used for the plain boards should be put aside, and fresh colour, ground solely in strong varnish, substituted. This will probably remove the difficulty —if it does not, a very little curd soap may be introduced, taking care to add a little extra gold size to counteract the non-drying element furnished by the soap.

Let us assume that we have to print a very finely cut block, imposed with descriptive text set in small type, say nonpareil. It is evident that, besides depth and brilliancy of colour, we here require other attributes, *i.e.*, the ink must not only be rich in colour and body, but it must possess the qualification of working clearly and sharply without filling up or wiping. The best way to secure this result is to carefully grind one's ink in strong varnish, taking care that the pigment is the best to be had in the market, and to make a careful selection of a suitable roller. To this end we want a roller possessing qualities almost the opposite of those described in the previous example. Under any circumstances, and with the best and cleanest working ink which was ever made, it would be no easy task to work a fine cut clearly with a hard roller; but when dealing with an ink like ultramarine it would be an impossibility. We must therefore select a good fleshy roller, not too new and only slightly damped. If the roller be too fresh, it will not take up the ink at its full strength, and a varnish but slightly impregnated with colour will be printed on the paper. Assuming, then, that the quality of the pigment is first rate, the roller in fair condition, and the ink well ground stiff in strong varnish, we have all the elements necessary for successfully printing this page.

These illustrations show how illogical it is to use one class of ink for all classes of work; yet this is what many small printers do. They order a few pounds of blue or any other colour from the ink maker, and expect it to print with satisfaction work differing in its character as widely as the two illustrative cases we have given.

When mixed with white ink, ultramarine forms beautiful bright blues, varying in depth and intensity according to the quantity of white used with them. In comparison with the light blues formed with Chinese blue and white, the palm of beauty, in the author's opinion, remains with the combination of ultramarine and white, which is purer and brighter—at all events by daylight; for when viewed by artificial light the blues made from ultramarine and white lose their purity and take a slatish-purply hue. The combination of Chinese and white, on the contrary, retains its normal colour under all circumstances; and on this account it is perhaps preferable to ultramarine and white for work which is much scrutinised by artificial light.

In the absence of purple lake, ultramarine may be used with carmine in the production of purples, and with carmines and whites in the production of mauves and lavenders.

Antwerp Blue is a colour but little used by the colour printer; in chemical composition it resembles Chinese blue. It, however, lacks the depth of that pigment, which gives all the results that can be obtained from Antwerp blue.

Cobalt Blue.—The cobalt blue of commerce is the metallic oxide of cobalt. In appearance it resembles ultramarine, but is less dense in colour. When mixed in middle varnish and properly ground, it yields a printing ink similar in character but inferior in brilliancy to ultramarine. But it possesses many qualities which that pigment lacks.

Cobalt is a valuable colour for sky tints in fine colour work. Strengthened with a small quantity of Chinese

blue, it yields a deep rich blue, more opaque than similar tones of pure ultramarine. Made into tint with varnish or white, it works well and dries rapidly.

Like ultramarine, it may be used with lake or carmine in the production of mauves and lavenders. By itself it gives a printing ink less opaque than the same tone would be if produced from ultramarine and white. This may be illustrated by the following fact, which actually occurred within the author's experience. Some proofs had been pulled under Mr. Owen Jones's direction in pure cobalt on a white ground. It was afterwards determined to print this particular combination upon a light buff ground, which was done. When the work was finished and milled, it was discovered that what should have been a pure blue had a greenish tone. On investigation it was then recalled that the semi-transparent cobalt had been used for the blue; the yellow ground had consequently shown through and imparted the greenish tone to the ink. The cobalt would have printed with satisfactory results on a white ground, or on a ground which would have supplemented its strength of colour, such as pale blue or a pale blue purple. In the case we have been discussing an opaque blue made of ultramarine and white should have been used.

Indigo.—Except for tints, indigo is a pigment of but little value to the printer. In tint with varnish it is useful in the production of various greys, and its use will be further indicated when dealing with tints.

The subject of blue printing inks is now finished; and in closing our remarks thereon it is only necessary to remind the reader that Chinese, ultramarine, and cobalt blues are the basis of nearly all the blue inks in the market, either by themselves, in amalgamation with each other, or with white. Cobalt and Antwerp blues are now but rarely used. Chinese blue offers no difficulty in its

management. The student should therefore direct his attention to the peculiarities of ultramarine, which probably offers more scope for original research than the whole of the other pigments put together.

GREENS.—The number of pigments available for the purpose of making green printing ink is somewhat limited. The most intense, vivid, and brilliant green we have (emerald) is incapable of assimilation with printers' varnish so as to make practical printing ink. When, therefore, this colour is required in its normal beauty, it must be used as a powder and dusted on. It is, however, a very deadly colour to use, being made from arsenic, and its use should on that account be persistently discountenanced.

The green pigments really available for printing purposes are the following: First, there are the mineral greens known as *drop green lakes*. Until recently these were imported from France or Germany, and are sold in the form of very small cones at about 3s. per lb. These greens are now largely manufactured in England, and are made in several shades of colour, from a light yellowish tone to a dense blue-green, which prints almost a black. Secondly, there are the greens made from lemon chrome and Chinese blue, by means of which any of the tones given by the green lakes may be imitated; in the light and middle tones greens produced in this way are not so bright as those furnished by really good drop green lakes.

Drop Green Lakes.—In making up these green inks in small quantities the reader is recommended to proceed as follows: Take, say, a quarter of a pound of middle litho or letterpress varnish, and having pulverised as much of the colour as you think the varnish will take up, mix it stiff, and grind well with a stone muller. If the green lake is of fair quality, this should produce a half-pound of good bright green ink, which will work and dry well on ordinary printing papers. Should this be too light in

shade, a few drops of the deeper-toned green must be pulverised and added until the tint required is attained.

If the colour be too dark, either a paler green lake must be chosen and fresh colour made, or the ink may be modified by the addition of the palest shade of green lake.

If a very yellow green be required, lemon chrome must be added to the palest green lake. The autumnal hue of foliage may be imparted by the addition of burnt sienna, or indeed of almost any of the warm browns.

Sage and slate greens may be made by adding to them, in small quantity, black and red in such proportions as must be governed by the tone of the colour required. Mixed with white ink, the deepest drop green lake gives a very bright blue green; and in tint, with either white or varnish, these pigments are all effective and reliable colours. For very fine work it may be necessary, as is the case with most other colours, to grind them in strong varnish.

Drop green lakes are in themselves good drying colours, and for ordinary papers no driers need be added; for enamelled papers a little gold size may be used. When ground in thinner varnish for machine work, a little of the tube driers may be added.

In using inks made of these mineral greens the printer will sometimes find that the ink corrodes on the slab and works gritty. When this happens he had better discard the colour at once, for he may be sure that the pigment is either adulterated or requires washing. By "washing" is meant grinding in a water mill, during which process the impurities of the colour are got rid of by evaporation. Good drop green lakes should, and always do, work well and clearly. They are, in fact, invaluable to the colour printer as effective bases of all his green inks; and if he obtain them in purity, which is not difficult, he need not look further for material for his green inks.

Chrome Greens are mentioned here merely to acquaint the reader that they may be used as a possible substitute for mineral greens when the latter are too expensive or cannot be obtained.

Imitation Emerald Green.—Great efforts have been made, and made successfully, to produce a green pigment approximately imitating the beautiful lustre of emerald green. It is believed that these greens originated on the Continent; but whether this be so or not, they are now largely manufactured in England, and are sold commercially in the shape of printing ink by nearly all the makers. Like green lakes, they are made in three different shades, *viz.*, light, medium, and dark; but, unlike the green lakes, they are remarkable for their transparency and brilliancy. They are, in fact, the nearest approach to the true emerald which the colour chemist has given us. In commerce they are sold under fancy names; but in at least two of the large ink-making houses in London they are described as "verdant greens." There is one peculiarity which must be noted: they do not dry. A tin of ink may be left for months, and not a particle of skin will be seen on it. The inference is obvious: use driers.

BROWNS.—Although the number of substances which may be used by themselves as the bases of effective brown inks is small, there is nevertheless no lack of means to produce browns in every variety of tone or shade.

Among the colours which produce brown inks by them selves may be enumerated burnt sienna, burnt umber, Indian red, York brown, Vandyke brown, maroon, and the common wood lakes, which are known by the names of brown lake, Florentine lake, etc. With the single exception of maroon, which is made of the residuum of the carmine pulp, the list in its unsophisticated state is a very weak one. We are not, however, tied to it for our browns, and although some of the above-mentioned colours make

effective browns of a certain class when used alone, yet their chief value rests upon the claim they have to form with other colours many valuable inks.

Burnt Sienna, or *tierra de sienna*, is a natural earth, burnt into a transparent reddish-brown pigment of extreme hardness, which necessitates a deal of grinding.

In dealing with burnt sienna it is best, as it is a cheap colour, to choose that sort which is called refined, and is sold in a very fine powder. If this be mixed stiff in strong or middle varnish it yields a bright red brown that is very useful in many descriptions of fine colour work, because the effect it gives cannot be matched or imitated by any combination of other colours. For ordinary commercial, label, or show-card work it does not possess sufficient strength to be used alone; it may, however, be modified and enriched by the addition of carmine or lake. It is the best colour to use when it is necessary to impart the brunette tone to flesh tints; when very pronounced flesh tints of this class are required, burnt sienna and varnish alone will often give them.

This pigment is also valuable for mixing with greens to deprive the latter of obtrusive brightness in foliage; and it is used as an ingredient—although its value in this respect is over-estimated—in the composition of gold preparations. Burnt sienna is a powerful drier by itself, so that no driers need be used with it. A fresh roller suits the peculiar habits of this colour best, and great care should be taken that the ink is well ground.

Umber is a colour found in a natural state, and used by the painter or printer either in its raw condition or burnt. These colours possess remarkable drying properties, imparted to them by the manganese and iron which enter into their chemical composition. Burnt umber is largely utilised in colour printing. When mixed and ground stiff in varnish it gives a deep brown, inclining to yellow, which

does not possess much innate beauty. It is neither a bright nor a rich colour; nevertheless it is, on account of its unique drying qualities, especially valuable as the basis of browns, which receive their richness and warmth from the colours amalgamated with the umber.

Burnt umber, ground stiff in middle or strong varnish, may be modified as follows: A brown ink of a distinctly yellow tone may be obtained by simply adding to the stiff colour more varnish, thus making it transparent. If vermilion red be added to umber ink it gives a reddish yellow-brown ink of good body; lake or maroon will give a brown somewhat similar to the last, but deeper, more crimson, and richer in tone. Magenta and purple lakes added to umber produce a rich brown of the maroon character, which may be occasionally very useful, but which will be inferior in strength and beauty to the best cochineal maroons, which give rich velvety colours, very nearly as brilliant, and of greater depth than carmine itself.

Raw Umber in some phases of colour printing is a useful pigment. It is a very hard colour, and to make a reliable printing ink it requires a large amount of grinding. It is not generally kept in stock by every printing ink maker, the demand being too small to warrant him in stocking; but if the makers do not keep it in stock in the shape of ink, they generally have it in the form of powder. In this condition it is easily dealt with. The printer only requires a perfectly clean slab and muller. Let him mix a little of the dry colour fairly stiff in some middle litho varnish and grind it perfectly smooth with the muller. This done, the ink may be reduced with varnish until the depth required by the particular job is attained.

Raw umber is not a colour that is largely used in chromo-pictorial or oleograph work; for it lacks the depth and body which that description of work requires. On the other hand, it gives delicate flat tints wholly free from

any suspicion of vulgarity, and for this purpose and in this respect it is superior to most of the chromes used in their unmodified condition. Hence raw umber tints are used when there is a positive colour, such as black or brown, to print on the top. This effect may frequently be seen in the specimen sheets sent out by the large typefounders. For purposes like these the colour answers admirably.

Raw Sienna.—After the remarks made in reference to raw umber it will not be necessary to enlarge upon the peculiarities of raw sienna. Both sienna and umber are earths which are sometimes used in their natural state and sometimes burnt; although the burnt varieties are very much more largely used than the raw. Everything that has been written with regard to raw umber may be applied to raw sienna. With the single exception of the tone of the colour, which is warmer than the umber, its treatment in every respect is the same. In conclusion, if the printer is using these colours for proving flat tints at the hand press, and he finds his roller after a little while getting gritty on the surface, it is a sure sign that his colour is not properly ground.

All the browns made with umber give printing inks more or less transparent, and all of them have a yellow tone. This may not always be apparent unless on comparison with browns containing no umber. If, however, the reader compares an impression pulled in any of these umber browns with one of lake (or carmine) and black, the yellow element in the former will be distinctly visible. Burnt umber is also valuable for many tints, either with white or varnish: for instance, when mixed with white it gives an effective stone colour.

Like sienna, umber is sold both in lump and in powder; the latter is the best condition in which to buy it. It is also useful as the body colour in certain gold preparations.

In printing with these, or with pure umber brown, the roller requires precisely the opposite treatment to that needed by vermilion red. In the latter case the roller can scarcely be too dry; in the former it can scarcely be too damp. Umber, when not largely modified by some of the non-drying lakes or carmine, very soon causes the roller to "go off," *i.e.*, to get dry on the surface. A fresh roller should be used in the first place, and when the ink used has become so dry on its surface that it no longer bites the slab, the roller should be washed in turps and sponged in water.

York Brown is a cheap and somewhat warm pigment of the ochre class. In tone it resembles a deep warm Roman ochre. It is not suited for fine colour work, but may be used for the foregrounds of common illustrated posters. It dries well by itself, and makes a printing ink which gives little trouble in working.

Maroon.—This colour is the richest and the most beautiful brown pigment of which the colour printer can avail himself. It is made from the dregs of the cochineal pulp after the pure carmine has been extracted, and consequently retains many of the peculiarities of that colour. Like carmine itself, maroon is largely adulterated, and the distribution of the debased pigment has done a great deal to destroy the reputation of one of the grandest colours which science has added to the resources of the colour printer.

In tone of colour, cochineal maroon can scarcely be classed among the true browns; it rather resembles that colour which is often seen in nature, and which, coming between carmine and purple, cannot be said to be either one or the other. When great richness is required, maroon is a colour eminently adapted to give that result.

In making maroon into printing ink the directions given in the case of carmine apply equally here; its non-drying qualities are precisely the same. When mixed with black

it forms a rich, dense chocolate brown; and when used for enamelled papers it prints and glazes well.

The adulterated specimens of this colour are simply execrable, and many of them are mere wood lakes, destitute of both body and colour. Genuine maroon used not usually to be sold in a dry state; it was and may still be bought in pulp in quantities of fourteen lb. weight and upwards, and so obtained should be placed on a hot plate or on the top of a boiler, and evaporated to dryness. Fourteen lb. weight of pulp will yield from two to three lb. of dry colour, and will cost about 5s. per lb. Many of the large dry colour makers, however, now sell maroon in a dry state under the name of "maroon lake," and a few of the large printing ink makers sell it under the same name as ink.

On account of its great richness, maroon is a valuable colour for white letter blocks in show-card work, or for tablets of any description; it is also largely used in the best card-back and high-class label work. With regard to its working qualities, all that has been written about carmine may be applied equally to maroon.

Indian Red is a pigment belonging to the ochre family, which gives a good serviceable brown printing ink of a reddish tone; this colour, in fact, yields a brown which greatly resembles that given by vermilion and black, but Indian red is superior to the latter combination because there is no difficulty in printing from electrotype plates with it. When properly washed, this pigment, ground in stiff varnish, produces an ink which may be used for the finest press or machine work. Its depth may be increased to any shade by the addition of black.

A firm and rather fresh roller should be chosen. It dries well by itself on ordinary printing papers; for enamelled papers driers are required. This colour is largely used in some offices of importance, and it is occasionally known by

the name of *Italian brown.* It absorbs moisture very rapidly, and should therefore be kept in a dry place.

Agate.—This is the name of a beautiful brown introduced in its dry state by Steinoff. It may be said to possess every quality valuable to the printer. It is rich in tone and works remarkably well.

Miscellaneous Browns.—Besides the colours we have already dealt with, very rich browns may be made with carmine, maroon, and black; with purple lake, maroon, and black; and with crimson, scarlet, or magenta lake and black. The last is the cheapest pigment to use. As lakes do not possess much body by themselves, the ink should be mixed very stiff when they are used as the basis of browns. Any of the above amalgams may be modified by the addition of Indian red. Vermilion incorporated with black yields a foxy brown.

In making lake or carmine the basis of browns, the result is totally different from the browns of which umber is the basis. In the former there is a rich chocolate tone; while in the latter the yellow hue predominates. This is, of course, modified in proportion as lake or carmine is added. Where rapidity of drying is essential, the reader is recommended to avoid the cochineal browns, and, if the tone of colour given by the umber browns be not unacceptable, to use them instead.

Yellow browns may be made with medium chrome and purple lake, or with medium chrome and Indian red. Firm rollers, inclining more to freshness than to dryness, are as a rule best for these colours.

There are some crimson and scarlet lakes in the market which are as brilliant in colour as the best carmines. These lakes are known by the name of "brilliant lake," and are of French manufacture. They are the best substitutes yet discovered for carmine, and are in every way adapted for the production of rich crimson browns, as they possess the

invaluable property of drying hard and rapidly. When ground in strong varnish and a little gold size they produce a gloss red without further trouble.

BLACKS.—Black ink is one of the most difficult to make properly, and, although the black inks of commerce have now reached a high state of perfection, it is the result of the cumulative experience of four centuries of experiment. These commercial blacks are, many of them, admirable in their way. They answer the purpose for which they are designed, and are, consequent upon the competition incident to the trade, moderately cheap. There is, however, another sort of black ink not so largely used, of which the manufacture is not nearly so well understood, and that is the ink used for printing on enamelled surfaces. If we try to use the ordinary blacks as supplied by the ink makers, disappointment often follows. Sometimes they print washy, as if there was no body in the ink; sometimes they print tolerably well, but the ink refuses to set or harden on the enamelled surface; sometimes a superficial skin forms on the outside, but the ink does not bite the surface of the enamel—there is practically no adhesion, and the ink may be wiped off by the pressure of the finger months after the printing has been done. In dealing with black inks it is of this phase only that we propose to treat.

The pigments commonly used in the manufacture of black inks are—Paris, ivory, and Frankfort blacks. Of these, Paris black is the most valuable. In order to make a good black enamel ink the black pigment should be rubbed into strong varnish. To this should be added one-fourth its bulk of Chinese blue ink and a little gold size. This will give us an enamel ink which generally answers all the purposes required of that substance, *i.e.*, we shall have an ink which will print solidly upon any sort of enamelled paper or cards, which will adhere to the enamel, and which may be depended upon for its drying qualities.

It very frequently happens, especially in small offices, that this difficulty of printing solidly occurs; and as it is not always easy to get good Paris black in small quantities, the printer may assist himself in this direction by adding ivory black (which may be readily obtained of most colourmen) to any good commercial ink he may have by him.

Thus, suppose we have a quantity of highly glazed enamelled cards to print from a type forme, and that the only ink available is some 2s. bookwork black. If we try to use this, it will probably print on the enamelled cards more like a stained varnish than a full-bodied ink. If the printer takes some of this ink and rubs into it as much of the ivory black as the ink will take up, and grinds it up with a muller, he will probably have so far modified his ink in the right direction as to get him out of his difficulty. If he can obtain a little strong varnish and Chinese blue, he will be in a still better position to assist himself under such circumstances.

CHAPTER LXXIX.

COLOUR PRINTING (*continued*).—Tint Inks—Opaque—Transparent.

Tint Inks.—Tint inks used for letterpress printing are of two descriptions: they are either opaque, made with white; or transparent, made with varnish. So far as facility of working goes, the opaque body tints offer greater difficulties in their management than the transparent or varnish tints. Either of these classes of colours may be made with any of the positive colours, the examination of which has just been finished.

It frequently happens, in using tints of which flake white is the basis, that the colour does not lie flat, but prints motley and uneven. This very rarely has anything to do with the colouring matter used to form the tint, but arises from the fact that the white does not properly clear the forme. It may in most instances be controlled by the addition of a little soap.

Opaque Tints.—Taking the opaque tints first, we require, say, a pound of the white ink, the manufacture of which has already been described. The ingredients for this will cost about 1s., namely, half a pound of flake white, 3d., and half a pint of strong varnish, 9d. This white basis may be converted into any tint desired.

Opaque Yellow Tints.—If a very pale primrose yellow tone is required, a little lemon chrome should be added to the white; if a warmer tone of yellow is wanted, a little of the medium shade of yellow should be used; and if a deep buff is wanted, add to this a little orange chrome.

Opaque Pale Buff Tints may be made with white and a little orange chrome.

Opaque Flesh or *Salmon-colour Tints* are made by adding a little vermilion to the white basis.

Opaque Pink Tints are made by mixing with the white a small quantity of pure carmine or scarlet lake. If the pink is required for common work, where great purity of tone is not essential, magenta lake may be substituted for the carmine. The quantity of carmine used must of course be determined by the depth of tone required.

Opaque Mauve or *Lavender Tints* are made by adding a little purple lake to the white. If a reddish shade is desired, a little carmine should supplement the purple; if a bluish tone is wanted, a little ultramarine should be added instead.

Opaque Blue Tints are made by adding to the white basis small quantities of either ultramarine, cobalt, or Chinese blue. The former have a purplish tone, which approaches slate colour by artificial light; while the tone of the latter under the same conditions inclines rather to green than to purple.

Opaque Green Tints.—Any of the shades of drop green lakes may be used with white; for a very delicate and light blue green tint, take from five to ten drops of the deepest shade of green lake and grind up with a quarter of a pound of white ink. If the green tint is required less blue in tone, the medium shade green should be used instead; if a still lighter tone is wanted, the palest shade of drop green lake may be used; and if a yellow-green is required, some of the green lake must be omitted and lemon chrome substituted in lieu thereof. Any of these shades of green may be modified by the addition of burnt sienna, of red-purple lake, of any of the warm browns, of carmine or scarlet lake, or of deep orange chrome.

Opaque Brown Tints may be made with raw umber or

raw sienna, which is warmer than the umber, worked into a flake white basis.

Opaque Reddish-brown Tints may be made with burnt sienna and white, while burnt umber and white produce a stone colour.

Opaque Purple-brown Tints may be made with Indian red and white, or by adding to the white a little orange chrome and purple lake.

Opaque Greys may be made by simply adding a little black to the white basis, but a large variety of grey and slate-coloured tints may be made by modifying this. Suppose we take six separate ounces of flake white ink, and a quarter of an ounce of black to the first ounce of white, reducing the quantity by a sixth until we reach the sixth ounce of white, it will then be found there is very little black left to tone the white. However, we have now six strengths of normal grey—the colour being made of black and white, the tone is the same throughout; but the strength is different on account of the diminishing quantity of black. If, before washing this away, we would like to keep a record of what we have done, we should get a plain bit of zinc or sycamore, then get a roller sufficiently long and pull an impression of the six different greys upon one sheet. We may find this useful for future reference.

Instead of using the black ink in its integrity, the sixth part of Chinese blue—well ground—may be added to the black, and then the grey made as in the former case. If we pull an impression of this as we did in the first case, we shall have a valuable means of reference in the future.

Again, a little purple may be added to the black and white, which will deprive the latter of its severe coldness. Warm greys may be made with a little lake or carmine added to the purple, black, and white, or by adding some Indian red and indigo to white. Indigo and white by themselves give a good cold grey.

Opaque tint inks such as we have just described are all body colours, having flake white for a basis; they are supplied in the way of trade by the ink makers.

In estimating the cost of any of these colours, they may be put down at a fraction over that of the white ink. The most costly of them is the pink made with carmine, but this colour is so powerful in itself, and a little of it goes so far, that the cost is scarcely perceptible. The main things to be aimed at in printing tints are that they should be pure and bright in colour, which result is attained by great cleanliness in the preparation, and that they should be perfectly even and flat all over, which is the result of the ink and roller being in a satisfactory condition.

It has been before observed that some pigments—white especially—are liable to separate from the varnish with which they are mixed, and adhere to the forme instead of being taken on to the paper when the impression is pulled. No body colour tint can print satisfactorily which behaves in this manner. If, therefore, a tint ink is found to print unequally, the first step is to ascertain if any of the ink has been left behind on the forme. If it has, this must be corrected by means which have already been indicated in analogous cases, namely, by the addition of curd soap or strong varnish. The question as to which of these two substances is preferable must be determined by the incidence of the particular job; but for heavy tablets the soap will doubtless be found most convenient.

If the ink is found to clear the forme properly and the tint still looks uneven, the cause must be sought in another direction, and it is probable that the condition of the roller will be sufficient to account for any remaining inequalities.

In printing flat tints in any of these body colours a roller should be chosen which is firm and fleshy, but neither new nor damp. If the roller is damp the forme will be wiped, and it is improbable that the full body of the ink will be taken

up and transferred to the forme. When, however, all the conditions of working are as they should be, much will depend upon the care and intelligence of the pressman in rolling his forme, so as to leave it free from any marks of the furniture or edge of the plate he is printing.

In printing flat tints at machine there is always a tendency, if the roller lifts are not adjusted to a nicety, for the rollers to leave a mark, and in this respect the system of diagonal rolling, invented many years ago, and now applied to single-cylinder machines on the Wharfedale principle, affords valuable assistance in removing difficulties of this character.

Transparent Tints.—Tints made with varnish alone are, whenever their use is possible, preferable to those made with flake white, and they are mostly used where another colour or tint is to be printed over them to get a modification of colour. The colour printer who deals much in tints may easily, and at very small cost, equip himself with the means of producing tints of almost any shade with scarcely any trouble. The principal artists' colourmen prepare oil colours for the use of artists, and sell them in tubes at from 6d. to 2s. each. When pale tints of great purity are required, these tube colours are invaluable to the printer. They are prepared of the best material and are always thoroughly ground. All, therefore, that is required is a selection of these tubes and some strong varnish. The reader is recommended to provide himself with the following:—

A tube each of medium chrome, orange chrome, raw sienna, burnt sienna, carmine, ultramarine, cobalt, indigo, Chinese blue, Indian red, Roman ochre, and burnt umber.

It must be borne in mind that these tube colours are principally recommended on the score of convenience; they are always ready; there is neither time nor trouble spent in their preparation; they are eminently suitable for pale

tints, but do not possess sufficient body for anything requiring much depth. All the effects they are capable of producing may of course be obtained by using in the same way the various pigments ground in printers' varnish; but the use of the tube colours is expedient, because they render this grinding unnecessary.

For large quantities of ink the use of tube colours would be out of the question on the score of economy alone; but for proofing and for small quantities they are extremely convenient.

Transparent Yellow Tints.—Suppose, for example, you require a pale tint of a subdued yellow tone, you have only to take, say, an ounce of strong varnish and add to it a little of the raw sienna from the tube, mix the two together with the palette knife, and the tint ink is made ready for printing.

Transparent Flesh Tints.—Again, if you require a delicate flesh tint, you have only to take the same quantity of varnish, squeeze a little vermilion into it from the tube, mix, and your tint is ready. The same may be said of the carmine and blues. A little of the former added to the varnish gives a bright pure pink; while a small quantity of either ultramarine, Chinese blue, or cobalt added to the varnish gives bright blue tints according to the character of the blue used.

Any of these tints may be made in five minutes; indeed, it may be safely said that in the whole range of colour printing there is nothing so simple and yet so certain as the production of tints in this manner.

Transparent Mauve or Lavender Tints.—There is no purple tube colour which is so suitable for making mauve or lavender tints as the purple lake used for making purple printing inks. When mauve or lavender tints are required, a little purple lake must be ground into the ink and added to the varnish; but a transparent mauve may be instantly

made with the tube colours by mixing with the varnish a little cobalt or ultramarine and carmine.

Transparent Green Tints.—In making these the remark applied to purples has the same application here. The tube greens, although well suited for the purpose they are designed for, namely, that of painting, are inferior for our present purpose to the drop and verdant greens we have already discussed in dealing with body colours. Thus, if pale green transparent tints are required, we must use a few of the small green cones of the tone required.

It will be remembered that drop greens are sold in three or four different shades. Grind either of them up separately, and then add this ink gradually to the varnish until the required shade is produced. If a bronze or olive tone is desired, lake or sienna may be added to this.

Transparent Red-brown Tints may be made by using sienna and varnish alone, by adding burnt umber and lake to the varnish, or by adding Indian red to the varnish.

Transparent Yellow-brown Tints may be made by adding Indian red and medium chrome, or purple lake and medium chrome, to the varnish.

Transparent Brown Tints of a purple hue may be produced by adding to the varnish Indian red and crimson lake. A large variety of brown tints may also be obtained by reducing with strong varnish any of those browns of which umber is the basis.

Transparent Greys of a bluish tone may be made with a little indigo and varnish ; these may be converted into warm greys by the addition of lake or Indian red. Any of the tones of grey may be made in the method indicated for the white, substituting varnish for the latter.

The Choice of Tints.—Having now stated the method of preparing tints, both as body colours having white and transparent ones having varnish for their bases, we now

approach the consideration of the question as to when and under what circumstances it is desirable to use tints prepared in one or the other of these ways. The principal objections to using the body colour tints are, firstly, the disposition which white always has to clog and not work clearly; and secondly, the liability which attaches to it of changing colour, and consequently impairing the purity of the tints made with it when exposed to light and air. The advantages which they possess, on the other hand, are that they afford the means of obtaining greater fulness and richness, especially with some colours, than would be possible with the purely varnish tints.

Tints made with white being perfectly opaque, they cover the paper better than do those made with varnish. For solid tints where it is essential that the paper should be so well covered that the ground is, so to speak, blotted out, the opaque body colour is preferable. In those cases, also, where gold, either metal or bronze, is a last working, any light tones forming the previous workings are better made with white, because they dry harder than if they were made with varnish, and there is less liability of the gold adhering to them should the last working happen to be gold.

In printing body colour tints, especially pale tones of ultramarine blue, or purple and white, an allowance should be made for the modification of tone which takes place in drying. All light colours mixed with white, more particularly those mentioned above, become paler as they dry, and the softer the paper the greater is the tendency to do so. Varnish tints, on the other hand, are more suitable where great body is not required, and where there is any fine work in the forme to be printed. For such work, for instance, as the engine-turned ground work of a banker's cheque, a tint made with strong varnish and the colouring matter alone gives a better chance of keeping the work

clear than one made with white, because there is nothing in the ink to fill up or clog the forme.

Those pale tones which enter into the composition of coloured subjects in several workings, and which are designed to print over and modify each other, should be made with varnish. It is obvious that opaque body colours would in these cases be wholly unsuitable, because the effects designed to be produced by one colour printing on another are only realised when the inks are transparent. It frequently happens that in the arrangement of colour blocks one colour is used to produce several effects. Thus, in a subject which contains a lemon-yellow, a pale blue, and a pink working, the transparent blue made to fall on yellow creates a green; made to fall on pink it produces a purple; the pink made to fall on the green gives it a brownish tone, and made to fall on the lemon-yellow produces an orange. If, in these and similar cases, the pale colours were made with white they would be useless, because they would be too opaque to blend with each other so as to produce their legitimate effect. With the exception of sienna, umber, and Prussian blue, varnish tints require the addition of driers.

We will now consider some of the more important tints in detail.

Yellow Tints.—The yellows given by chromes are in many instances—when unmodified by other colours—unsuitable for the production of flat tints which are not too crude in tone. It is true that if we reduce Nos. 3 and 4 we get in the first place some pleasing cool buff tints, and by reducing largely No. 4 we may obtain an acceptable variety of pale orange. These chromes are made in four different shades of colour. The first, called lemon chrome, is a pale lemon or primrose colour; the second, a few shades deeper, is described sometimes as light golden; the third, deeper still, is known as golden, and is very nearly as deep as a light

orange; the fourth is a very deep orange, and is not frequently used. But these varieties of chromes are better identified by their numbers, as they range from No. 1, the palest, to No. 4, the deepest.

If we take half-a-dozen portions of each number, and reduce each portion with increasing quantities of varnish, we shall get some useful tints which are very easily matched, especially those which are given by Nos. 3 and 4. No. 1 is of little use by itself in the production of a pale lemon tint, for when reduced with varnish it prints with a greenish hue. When, however, it is necessary to match the primrose flower itself, No. 1 chrome must be used, strengthened with a little of No. 2, and reduced slightly with white. But if we wish to match the crocus we have only to take a little of No. 3 or No. 4, according to the depth of our sample, and we have the colour at once.

Dismissing the subject of flat tints made from the various chromes, it may not be amiss to devote a few lines to the consideration of the very much more important functions they perform in building up elaborate pictures, whether printed by chromo-typography or chromo-lithography. It has already been remarked that the chromes taken by themselves are too bright and too crude to be used alone; but this remark, so far as picture work is concerned, must be taken with a qualification. In printing oleographs or chromos the chrome yellow working is generally printed first. It is hardly ever a warm colour—being made frequently of Nos. 1 and 2 chromes; but it forms the basis of the foliage in the background, and such is its strength that when sixteen or eighteen transparent colours are printed on the top the value of the yellow is seen distinctly showing through. Hence it will be gathered that the chromes must always be neutralised.

In a common chromo subject with few workings the colour itself would be altered. In a large subject with

many workings the later printings, falling on the yellow, effect the necessary change. As an example of this there was a very fine oleograph—a reproduction of Bougereau's "Nut Gatherers"—reproduced by the late firm of Letts & Co., at New Cross. The yellow, although printed first, is distinctly seen through all the other workings, and gives a delightful transparency to the whole picture. Again, we are most of us familiar with that popular picture by Burton Barber, where a little girl with golden hair is seated at the breakfast table with some dainties before her. A large dog forces his head on to the table, and the girl says, "Who invited you?" Now, the chrome, which in this case is light and rather warm in tone, goes nearly underneath the whole of the picture. It forms the first tone or basis of the girl's hair, the deeper tones being given by a sienna working to come later on. The reproduction of Leader's celebrated picture, "Tintern Abbey," is remarkable for the glow of the sunset. The first colour of this is given by a pale warm tint of No. 2 chrome, and this is worked up by some of the reds used in other parts of the picture. We have dealt fully with all the yellow tones and must now turn our attention to the reds.

Red Tints.—The number of red pigments suitable for reduction to tint strength is somewhat limited. First of all, there are two or three shades of vermilion. The deepest—and this may be some of the original Chinese—is of a rich crimson tone. Of the remaining two, one is somewhat dark in colour and the other is a light-coloured pigment, known as orange-vermilion. Besides these there are half-a-dozen different shades of madder lake. This is the most valuable red pigment available for the use of the printer. When properly ground it works smoothly, and whether used in tint or as a body colour, it always gives excellent results. Its main advantage as a flesh tint consists in the fact that it is absolutely permanent. It is deplorable to look

at some of the old chromos where a fugitive colour has been used for the flesh tint. The flesh colour has faded completely away, leaving the face and arms a ghastly white.

Besides the madder lakes and the vermilions, there are a few very beautiful pigments which are brilliant in colour and rich in body, such as geranium lake, A C lake, rose red, etc., but these must be avoided as a pest if it is thought to use them in the building up of a picture. They are all fugitive in character, and if used the colour will not be seen after a few weeks' exposure to the light and air. Here, then, we are face to face with the two colours which we have to depend upon for our red tints, *viz.*, the vermilion and the madder lakes. The principal use made of these colours in printing is in the production of flesh tints, and each is suitable in its appropriate place. The vermilions, like the madders, are fairly permanent in character, and give tones of flesh wholly dissimilar to those furnished by the madder lakes; for whereas the latter are always pink and rosy in tone, suiting the complexion of a healthy country girl, the tints furnished by the vermilions lean generally towards the yellow side (the deep crimson vermilion must be excepted from these remarks). Not unfrequently it is found necessary to mix two together. From the pale and intermediate shades of vermilion, delicate salmon-coloured flat tints are obtainable, the amount of varnish mixed with the body colour determining the strength of the tint; while from the madders any amount of delicate rose-coloured tints are obtained.

It should be borne in mind that in printing tints made from vermilion, a copper electrotype must not be used, as the copper sets up a chemical action which turns the vermilion black. Copperplates intended to be used in printing vermilion should be either silver or nickel faced.

Green Tints.—Although the number of green pigments is comparatively limited, the variety and beauty of the flat tints obtainable from them are very remarkable. To any one unac-

customed to the practice of chromo printing it may seem strange that green as a colour in itself is hardly ever used as a separate working in chromo subjects. The greens are nearly always obtained by the blending of the yellows and blues; so that, here, we shall not have to consider the greens as even remotely connected with the building up of a picture; but, as has already been remarked, we can devote our attention to the large variety of flat tints which may be made out of the material at our disposal, and these tints may be either opaque made with white, or transparent made with varnish.

There is a variety of green pigments sold by the dry colour makers under the name of green lakes. These green lakes are made in four different shades, ranging from a pale yellow-green to a deep blue-green. They are always in the form of small pastilles, and when well ground give reliable, clear working, and bright green inks. There is another variety of green made in three shades and known by the name of verdant green. This is a green of extreme purity and brilliancy. It may be considered almost as an innovation, as it has not been on the market for many years. If to these we add the lemon chrome No. 1 and a little yellow lake ink, we shall have all the materials necessary for the production of a large variety of green tints.

As it is somewhat doubtful whether one gets green lakes from the ink maker, it is well to make sure of getting the right thing by buying a small quantity of each shade of the dry colour and making it up oneself into printing ink. This precaution is necessary, because when made into printing ink there is very little difference in appearance between green lake and chrome green ink costing a third of the price. Having obtained the dry colour, a small portion of each should be mixed stiff in middle litho varnish and well ground, and that part of the arrangement is finished. With respect to the verdant green there is no possibility of making a mistake

—the character and texture of the colour are unique and cannot be tampered with.

Dealing first with the opaque tints made with white, we mix a little of each of the body colours with about six times its bulk of white. If a sheet be now pulled, we have four very pleasing shades of light green, ranging from a light yellow-green at the bottom to a light blue-green at the top. These again may be further modified by increasing the proportion of white to eight times the bulk of body colour. The same formula may be applied to the verdant greens, but these are brighter and more transparent than the green lakes. Any variety or strength of tint may thus be obtained either with or without white and with little trouble.

We shall now take leave of these opaque tints made with white and devote a few lines to those other greens which have been modified by the introduction of other colours. Suppose we require a very delicate yellow-green, very pale and very yellow in tone. In this case we take a portion of the palest yellow lake. This in itself gives a pale yellow-green, but not sufficiently yellow for our purpose. Therefore to obtain the desired result some of the No. 1 yellow chrome must be mixed with the green lake. Then we get a clean, pure, light yellow-green which gives a pleasing flat tint. If, again, we desire to still further alter this last colour, and indeed to change its character, we have only to add a small portion of burnt sienna and we have a sage green. These last remarks apply to any of the reduced greens (without white), as the addition of a little burnt sienna changes the character of the greens and gives to them that warm tone suggestive of autumn. Sometimes the bright verdant greens are toned with black, and the effect is by no means displeasing. Care must, however, be taken that only just sufficient black is used to neutralise the brightness of the green. In conclusion, it may be noted that with the exception of the results given by the verdant greens, which have

a character of their own, all the foregoing may in case of necessity be imitated by green inks made with chrome. The result is not, of course, so good as the green lakes; but where the latter are not available the chrome greens may be used as a substitute.

Blue Tints.—From every point of view in chromo printing the blues used are among the most important colours. They are rarely seen in their integrity except in those cases where they form the first tone of a sky or supply the colour to a stream in the foreground of a picture. In a chromo consisting of twelve to sixteen workings there would be at least two and possibly three blue plates, each printing with a different strength so as to give, when overprinting and blending with the yellows, all those varieties of greens which are seen in a finished picture. Besides being used to neutralise the yellows, it is made to serve the same purpose by causing it to overprint the red where it is thought necessary. This treatment changes the red to purple, thus adding largely to the variety and beauty of the picture. A list and description of those blue inks which are commonly used in printing—and for that matter, in painting also, for the painter is equally restricted with the printer in his choice of blue pigments—is as follows: Chinese blue, ultramarine blue, cobalt blue, and cerulean blue, and their amalgams.

Chinese blue is the basis of a great many of the blue inks of commerce. It is hard in texture and needs careful grinding, when it works well either on tint or body colour. Mixed with white in various proportions, it gives light blue flat tints in any strength of colour; only the blues in tint furnished by this colour tend towards green in tone, although this is not observable until they are compared with the other blues which distinctly tend towards purple in tone. Sometimes Chinese blue is amalgamated with ultramarine, thus giving excellent results.

Ultramarine blue is a colour which in point of quantity

used would outstrip the Chinese. It is the basis of those vivid blues which are seen on the hoardings in the public streets. For our purpose it is useful amalgamated with white in the production of pale flat tints. It is also occasionally used for the sky in chromo work, in those cases where the sky follows the ultramarine character. Cobalt blue is a blue of great brilliancy and delicacy. Although in tone it resembles ultramarine, it is not so coarse, and it prints with beautiful smoothness. This colour in tint with varnish alone gives clean blue tints of great purity, and mixed stiff in middle varnish it gives a rich, dense, well-covered blue which realises the deep blue sky of Italy. Cerulean is a very light blue pigment, suitable for certain light tones of sky. As the tone may easily be imitated by mixing the other colours, it is not worth while to consider it here, especially as it is very costly.

To suit the exigencies of various jobs, the above blues are all subject to modification, as one or the other of them is almost sure to enter into the composition of the skies. In some parts of these there is a distinctly purplish tone. It is true that the artist may have worked the red into the sky with the view of neutralising the blue, but he may find when the blue is printed that the red does not do enough; hence the alternative he has is to make his blue warmer by the addition of a little madder lake.

Mauve and Purple Tints.—Under this heading are comprised all those pale tints which are variously known as mauve, lavender, etc., and which are all varieties of purple reduced with white or varnish. There are some very beautiful varieties of purple lakes on the market now. Mixed with white or varnish they give pure, bright, light mauve tints, but unfortunately the purple lake is usually made from aniline, and is therefore unreliable and fugitive in character. So that if we wish to make tints of this char-

acter which will stand, we must discard the purple lake and substitute therefor a mixture of cobalt and madder lake, or, if a cheaper colour be desired, ultramarine and madder lake. These mixed with white will give the results required, and will be fairly permanent.

Brown Tints.—Two colours require a little attention. These are burnt umber and burnt sienna. Burnt umber is very rarely used in chromo work. It is, however, used like raw umber as a flat tint in architectural work. A little of it mixed with white matches at once the walls of an old castle. It is used also as a flat tint for a positive colour to print upon. Burnt sienna, on the contrary, is much used in chromo work. In various strengths of tint it generally enters largely into the building up of the hair; and it is also used to modify the foliage where an autumnal tone is required.

CHAPTER LXXX.

COLOUR PRINTING (*continued*).—Gold and Silver Work, with Bronze Powders—Gold Leaf and Dutch Metal—Gold Preparations—Printing Gold over Colours—Dusted Colours.

GOLD and silver are so frequently combined with colours that some observations additional to those already made in Chapter LXXV. will be found useful.

Gold Printing.—Under the head of gold printing is comprised printing in bronze, gold leaf, and Dutch metal. Of these the bronze powder is by far the most generally used; gold leaf is used for very high-class work, and Dutch metal is largely used in show-card work of the best class, where the ordinary bronze powders would not be considered sufficiently bright for the purpose.

Bronze Powders are made in many shades of colour and are milled to various degrees of fineness. In some of them the particles of metal are so minute that the bronze powder is almost as fine in texture as flour; in others, the metallic particles are much coarser in grain and may be seen with the naked eye. Where the fine and highly-glazed bronze powders are, metallically, of good quality they are unquestionably the most economical to use; for a pound of fine-grained bronze will frequently go twice as far as one of the coarser kind. Bronze powders, however, which are very smooth and fine in grain have a tendency, on account of that very quality, to blacken most printing papers which have not been enamelled, and this is the case even when the paper used has been highly rolled. This damaging effect is of less conse-

quence when the forme printed is a very solid one and covers the paper well, but if the forme or block be an open one the discolouration of the paper is, of course, very prejudicial to the appearance of the work. For example, suppose we have a forme of four 4to pages, consisting of borders only, to be printed in gold bronze on good paper which has been well rolled; if the bronze chosen is too fine in texture the minute atoms will, by adhering to the fibre of the paper, discolour it and spoil the work. This is true even when dealing with such a hard and highly-glazed substance as ivory cards, for very fine bronze will cling to and discolour their surface. It follows, therefore, in these cases, that the remedy is to discard the fine bronze and choose a coarser one. In dealing with enamelled papers this difficulty of the bronze clinging to the surface never occurs, because the coat of enamel which the paper has received, and the milling it has undergone subsequently, have filled up the small irregularities on the face of the paper and produced a smooth and glossy surface, from which the finest-grained bronzes may be cleanly wiped off.

There is another disadvantage which attends the use of bronze powders which have been milled very fine—they never exhibit so much brilliancy when printed and glazed as do the bronzes of coarser grain, nor do they belong, as a rule, to the highest class of bronzes. The best and most brilliant bronze powders are always more or less coarse in grain, and when examined in the papers should exhibit a bright metallic lustre; the inferior ones have a dull, brownish hue instead of the bright yellow gold colour which is characteristic of the best sorts.

For the purposes of the colour printer, bronzes of coarse grain are, independently of the question of quality, preferable to the fine ones. Coarse bronze never soils the paper, if the printing is on ordinary printing paper; while, if the forme being printed in gold is a last working and prints over the

colours, there is much less liability of a coarse bronze adhering than there would be if a fine one were used. For work, therefore, which has any pretension to high quality, choose a coarse bright bronze of good quality; for commoner work, especially if enamelled paper be used and economical considerations are important, a finer bronze may be used; for gold last printings, always choose a coarse bronze.

Gold Leaf.—If gold leaf is what it is represented to be, it is the easiest class of gold printing. Assuming that the adhesive preparation—which will be dealt with further on—is all right, it offers no peculiarity calling for remark, and, in reference thereto, it will only be necessary to describe the method of laying the leaf, which differs from that adopted with Dutch metal.

Gold leaf is generally laid in the following manner by those who are most expert in dealing with it: Take a piece of cardboard a pica less all round than the size of the leaf to be laid; cut the edges of this round at the corners: then get a piece of very thick sealing wax, about an inch and a half long, and stick it in the middle of the card; gently lift the paper off the gold leaf and place the card, holding it by the wax handle, on the top of the leaf; if the gold be now gently blown over the edge of the card the leaf may be raised thereon and deposited in its proper place on the printed sheet. This is the professional method of laying gold leaf, and a little practice and attention will soon render any one proficient therein.

Dutch Metal is an imitation of gold leaf, and is sold in bundles of 2,500 leaves each, at from 3s. to 10s. per bundle; it is used as a substitute for the pure gold leaf and is made in many different qualities. Of the three varieties of gold work that of Dutch metal printing is by far the most troublesome. In bronze work the chief thing to be aimed at is to satisfy oneself that the bronze will adhere to the adhesive medium used. In metal work we not

only have to satisfy ourselves on this point, but we must make sure that the metal will lie perfectly flat and smooth, and that it does not break at the edges when it is wiped out after the printed work is dry.

In all metal leaf printing the excellence of the work depends upon two main conditions, *viz.*, that the metal shall be soft and ductile, and that the adhesive medium used shall have strong tenacious qualities. When dealing with pure gold and silver leaf, we always find them so soft, thin, and even that when the work is wiped out the gold or silver lines are as sharp and perfect as if they were printed in black. This is not the case with Dutch metal, which is liable to break away, peel off in scales, and break irregularly at the edges of the work, thus showing a serrated instead of a sharp and clean outline. Many of these defects depend upon the quality of the metal used.

There are four distinct qualities of metal in the market; these are known by the numbers which are used symbolically to indicate their quality, No. 1 being the worst, and No. 4 the best. The two commonest varieties are hard, harsh, brittle, and uneven in colour. The qualities known as 3 and 4 are the best suited for printing purposes: these are fairly soft, are even in colour, and will print clearly and well if proper care be taken with the mechanical conditions upon which good metal printing largely depends; and it may perhaps be as well here to describe these.

It has already been observed that, in order to ensure the best effect in metal printing, it is necessary to make our work as flat and smooth as possible. This result depends partly upon the making ready of the forme, and partly upon the preparation used as an adhesive medium. To this end the forme, no matter what it may be, should be made ready with a hard impression, and the bringing up should be such that the impression should not "dip" in any part. In bronze work this is not of such great

importance, because the bronze dust is so fine that, no matter how soft the impression may be, the bronze is sure to find its way to every part of it; but if a forme intended for metal be made ready so that it dips instead of being perfectly flat, it will be difficult to force the metal leaf into those parts, and imperfect adhesion, with bad work, will be the result.

Assuming, then, that the forme has been made ready quite flat and level, an impression is pulled in the proper preparation, and the metal laid thereon; when this is done it is pressed into the impression with a large piece of cotton wool until it adheres to every part of it.

The metalled sheet may be placed on a type-high board with a blanket on the top of it, and pulled over in the press; this forces the metal leaf into every part of the impression and causes perfect adhesion. From the foregoing it will be seen that it is of cardinal importance that the metal leaf should be well pressed into the printed impression. If this is not done, no matter how good may be the quality of the metal or the character of the adhesive preparation used, the results will be always unsatisfactory.

Gold Preparations.—The most important qualifications which gold preparations should possess are that they should work clearly and dry with certainty.

In making up a gold preparation much depends upon the quality of the paper used. When dealing with ordinary rolled printing papers a preparation made according to the formula of the gold preparations sold by the inkmakers will generally answer the purpose. These usually consist of either burnt umber or burnt sienna ground in a stiff middle varnish, and with gold size added; but there are circumstances when this sort of preparation is valueless, and these will be noted as we proceed. When commencing a job in bronze, the first thing to be done is to make an examination of the paper or cards intended to be used,

with a view of forming an opinion upon their hardness or softness, because much depends upon an accurate appreciation of these qualities in making a preparation to suit them.

Supposing that we are dealing with an ordinary rolled paper, which is supposed to be of average hardness, a preparation made with two ounces of strong varnish and one ounce of gold size will, in nine cases out of ten, prove satisfactory; but the tenth case may be represented by a paper which is not of average hardness, and in this instance imperfect adhesion may be the result, through the absorption of the preparation into the paper. In this and similar instances arising from the same cause, when the work should be dry, it is found that the bronze may be wholly or partially wiped off. A preparation of this character should be stronger and more tenacious in character than the average preparations of commerce; it would certainly possess greater adhesive qualities, although the absence of sienna would render it not so quickly drying.

In considering and deciding upon the character of a gold preparation to be used, the qualities of tenacity and drying must be kept distinctly in the mind; they both form important elements in all adhesive mediums, but they must not be confounded with each other. You may use a strong varnish possessing very great tenacity, with powerful adhesive qualities, which will nevertheless take so long in hardening as to be, by itself, practically worthless as an adhesive medium for gold work. On the other hand, you may take a substance—gold size, for example—which will dry and harden with such rapidity that the bronze has not time to become set before the gold size has gone into the paper. Therefore, when we speak of strong tenacious qualities, it does not follow that we mean quick-drying qualities. The two attributes are wholly distinct; and while it is of immense importance that gold preparations

should be tenacious in holding the gold, it is not so important that they should dry with great rapidity, and by this we mean that they should dry in six or even nine hours, so that the work may be milled. It is, however, imperative that they should dry surely, and in the proper way, namely, on the surface of the paper and not into it. It is true that where time is a crucial consideration it is desirable that the preparation should not only dry hard, but dry quickly; but exceptional cases must be met by exceptional expedients.

Rapidity of drying may always be ensured where the result is absolutely necessary, although a preparation designed to dry and mill in a few hours would be unnecessarily stiff and difficult to work for general use. Whenever it is possible to use a preparation made solely with strong varnish and gold size it is always desirable to do so, because a preparation made in this way is sure to work more clearly than it would if a body colour such as chrome, burnt sienna, or umber were incorporated with it. It must be borne in mind that body colour is not introduced into gold preparations to accelerate their drying; the drying element is always abundantly represented by the gold size.

In making up gold preparations it is necessary to observe that the strong varnish and gold size used should be of the strongest possible character. That description of varnish known as extra strong litho varnish, and the gold size expressly prepared for printing purposes, should be chosen; the ordinary japanner's gold size is, on account of its thinness, not nearly so suitable. As a consequence of the common error to assume that good gold preparations must of necessity dry quickly, very much more work is spoiled through using preparations which dry rapidly than through using those which dry slowly. Strong tenacity is a much more valuable quality than rapid drying. For example, suppose we have a forme to print in gold bronze

upon soft, unmilled, enamelled paper. If we make a preparation by grinding some burnt sienna in strong middle varnish, and add to this as much thin gold size as the varnish used, we shall have a preparation which will possess every attribute to cause it to dry rapidly. In its composition it will very much resemble the gold preparation of commerce; and, although it is one which might be used with success upon some hard papers, yet if we use it in the case we are discussing the work will probably be spoiled. The preparation will be quickly absorbed into the soft paper; it will dry with great rapidity, but instead of sticking to the bronze and fixing it, it will sink into the paper before adhesion can take place, and when dry the bronze is not fixed, but may be wiped off the sheet. It follows, therefore, that in this case a quick-drying preparation is unsuitable; we consequently make our adhesive medium in a different manner.

Let us take a couple of ounces of the strongest strong varnish that can be obtained, and add to this one ounce of thick gold size; mix the two substances together with the palette knife, and pull a sheet on the soft paper we are dealing with. If we now lay this sheet aside for ten minutes and then bronze it, we shall be in a position to judge with certainty whether the preparation will answer its intended purpose or not. If the bronze adheres readily to the sheet and well covers the impression after this lapse of time, it shows that the preparation is not being absorbed by the paper, and that it may be used with safety. Had the same test been applied to a sheet pulled in the first preparation discussed it would have been found that it had all sunk into the paper, and that there was nothing left on its surface for the bronze to adhere to.

Still dealing with the same sort of paper, *viz.*, soft enamel, this thesis may be yet further illustrated. We take a solid, flat border and print it in a full ultramarine

or any other colour, and wait until the impression pulled has become perfectly dry. This solid border is therefore a flat colour upon which it is intended to print a gold ornament, which will accordingly print all over it; we will assume further that a coat-of-arms is imposed in the middle of the gold border, and will therefore print upon the enamelled paper itself. It is important to note particularly that one portion of this gold forme prints over a colour, while the other prints upon the paper. Now, if we take the quick-drying but rather thin burnt sienna preparation which has been described above and use it for this forme, we shall find that where the ornamental border prints over the colour the adhesion will be complete; but where the coat-of-arms prints on the soft enamel it will be found that the bronze will not adhere.

In this and similar cases mere rapidity of drying is not the quality which is most wanted; indeed, this attribute of the preparation we have been using, which is represented by the gold size, has done the mischief. It answered its purpose efficiently on that part of the forme which had a basis or foundation in the under-printed colour border, because this prevented its absorption—the preparation dried hard on the surface and the gold size fixed the bronze; but in that part of the forme which printed on the paper itself the preparation rapidly sank in, the gold size accelerated the drying, and, as a consequence, there is no permanent adhesion—the bronze may be wiped off with a rag, leaving this part of the impression just as it was pulled before the sheet was bronzed. The result would have been just the same if the forme had been printed in gold size alone—the bronze would have adhered to the border but not to the coat-of-arms.

In treating complex cases of gold printing like this, the preparation must be made to suit that part of the forme which prints on the soft paper; and the preparation made

of strong "long" varnish with a little thick gold size will in many cases prove effectual. It does not, however, suit the purpose in every instance: enamelled paper or card may be of so soft and absorbent a nature that even this very strong preparation may be sucked into it before the bronze is fixed on the surface; and when this is found to be the case, its strength must be increased by the addition of body colour.

In choosing body colour, it must be of a nature to answer the specific purpose it is designed to serve. In the case we are dealing with, the object we have in view in adding it to the already strong preparation is to cause this to lie on the surface of the sheet. It is not at all necessary for our purpose that the pigment selected should in itself possess great drying properties, but it is necessary that it should have the quality of bearing up and remaining on the surface of the paper, so as to resist absorption. There are several pigments which possess this attribute. Nearly all the scarlet and crimson lakes do, as also some of the chromes. In the present case the addition of a small quantity of dense chrome of the lake character, which was described when dealing with yellow pigments, will answer our purpose: this will cause the preparation to lie on the surface, and shows the value which, in certain circumstances, body colours have.

In the gold preparations of commerce, as body colour of one sort or another enters into their composition, it will be desirable to examine somewhat closely this aspect of the question. The pigment generally chosen is burnt sienna; but burnt umber, Roman ochre, and chrome are also used by the ink makers for this purpose. If we were to ask why the body colour is a constant and invariable ingredient of gold preparations designed to suit every description of work and every variety of paper, it would not be easy to give a satisfactory and logical answer. The fact is, that it is not possible to make a gold preparation which will meet the requirements of all cases. In many instances it is possible

—and, where it is possible, it is always best—to dispense with the body colour altogether; in other cases, body colour is an essential ingredient, because the preparation would not be sufficiently dense without it.

When printing on hard papers, body colour may nearly always be dispensed with, and a preparation made of two parts of extra strong varnish with one part of thick gold size will usually answer the purpose. A preparation of this character is infinitely better suited for fine engravings or small type than one made with the addition of umber or sienna. In the first place, the absence of all body will make it work more clearly; while the omission of the sienna or umber will be certain to keep the roller in better condition than would be possible if those quick-drying pigments were present.

In electing to use a preparation made without body colour, the only thing necessary is to satisfy oneself that it will bear up on the paper, and the method of taking this precaution has already been indicated. It is probable that the reason why sienna and umber have found so much favour as a basis for gold preparations is because they are powerful driers in themselves, and that approaching somewhat in colour to gold itself they tend to hide imperfect adhesion when it happens. Thus, if we use a burnt sienna preparation and the bronze does not completely adhere, the sienna renders the defect less visible. Regarded from this point of view, the chief value of these pigments is of a negative character—they are useful to hide a possible fault.

Under certain circumstances, the presence of sienna or umber is positively injurious. In cases, for instance, where we have to deal with deep ultramarine or emerald-green papers, these pigments should never be used; for they cause the preparation to dry so rapidly that it sinks into the paper before the bronze is fixed. The dense primrose chrome, which has already been particularised, should be used

instead. If this cannot be had, a little aniline lake may be substituted.

In suggesting a lake to be used as an ingredient of a gold preparation, it is necessary to say a word or two in justification of an innovation which would be regarded in some quarters as little short of heresy. In the first place, it is necessary to bear in mind that bronze powder is thoroughly opaque; consequently, it matters little what may be the colour of the adhesive medium used, provided always that the adhesion is complete. If the adhesion is not complete, it must be conceded that it is a practical inconvenience to have a preparation the colour of which would render this fault obvious; but if the bronze adheres perfectly, it is not material what colour the preparation is, even if it be a black. It will, of course, be understood that we are not recommending black to be used; it is mentioned as illustrating the proposition we are discussing with regard to the lake, and to demonstrate that the opacity of the bronze is such that it suffers no diminution in its brilliancy even when black is underneath it. This may be easily tested and verified.

Take a perfectly solid flat block—if nothing else offers, a large wood letter will do—and pull it in enamel black on enamelled paper. When this is dry, make a gold preparation of strong varnish and gold size, which will of course be colourless and transparent. If a small block or a few lines of type be now printed in this preparation upon the sheet pulled in black, it will be found that the gold will dry and mill without the smallest diminution of its brightness. This gives a result precisely analogous to that which would be produced if a black pigment were incorporated with strong varnish and gold size, and the adhesion of the gold bronze thereto was perfect.

The reason why we did not choose a black gold preparation to illustrate the proposition is, that the black pigments do not bear up well on the paper, and the least failure in the adhesion

would have permitted the black to have been seen. This might have been taken as evidence that the gold bronze was not sufficiently opaque to thoroughly conceal a dark-coloured preparation, and that, therefore, they were always unsuitable; by printing the bronze in a transparent preparation on a black ground this fact—the opacity of the bronze—is demonstrated.

If, then, we are correct in our assumption that bronze is perfectly opaque, it follows that where the adhesion is complete it is not very material what may be the colour used.

It may be, and no doubt is, very often expedient to use pigments which are similar in colour to gold itself; but when this is the case, it must be regarded as an expedient and not as a necessity. It should always be borne in mind that the colour of a gold preparation is never evident in printed work unless the bronze has been wholly or partially removed, and this never happens when the adhesion is originally complete and the bronze has been once perfectly fixed, or unless the work itself is imperfectly covered in the process of bronzing.

Reverting to the subject which suggested these remarks: we were recommending the use of two substances—the "lake brilliant" of Cornelissen, or the dense chrome of Dr. Cory—when dealing with papers of exceptional softness, as a means of preventing the preparation from sinking into the paper; and for this purpose they may be used with success, where an ordinary gold preparation would be absorbed as if it were thin varnish, and would, as a matter of fact, be utterly useless. This lake brilliant may be further used where it is imperative to make a preparation which will dry with very great rapidity.

If any sceptical reader, unconvinced by our reasoning, still deems the red colour objectionable, he may be reminded that a tinge of black will convert it into a brown only slightly different in tone from umber, or umber itself may be mixed with it in just sufficient quantity to convert it into a brown.

For a very quick-drying gold preparation, which will bear

up on any sort of paper, take one and a half ounce of strong varnish and mix with it half an ounce of brilliant lake; grind this well with the muller, and then add half an ounce of strong thick gold size. The lake in this preparation not only prevents it sinking into the paper, but it powerfully supplements the drying properties of the gold size. The work may be immediately placed without injury in the drying-room, and at the expiration of two or three hours it will be perfectly fixed and hard, so that it may be at once milled. As this preparation dries very quickly upon the slab, and consequently "lugs" very much, it would be manifestly inexpedient to use it when a weaker one would answer the purpose.

There is one other cause, which it is necessary to mention, for bronze not adhering, and that is, when the preparation is radically weak in its character. This may arise from the presence of thin varnish or oil, or from a miscalculation in the quantity or character of the gold size used. If too little gold size be used, or this be too thin, the preparation does not set at all, but remains moist. The same thing occurs if thin varnish is used in excess; but in these cases the symptoms are different from those in which the bronze wipes off through the too rapid drying of the preparation into the paper. Where thin varnish or oil is added, either through an error of judgment or surreptitiously, it remains wet and greasy, and may be smeared with the finger. Nevertheless, it must not be assumed that the use of a little thin varnish is absolutely prohibited; it must, however, be employed judiciously, with careful regard to the character of the paper being used.

If the paper is soft, it would generally be dangerous to attenuate the preparation with thin varnish; if on the contrary, it be a very hard-sized one, a good deal may be used with perfect safety. Thus, if we were dealing with a bronzed blue glazed paper, a preparation made of equal parts of thin varnish and gold size would prove effectual. The hard

character of this paper would prevent absorption, while the gold size would be sufficiently adhesive to both fix the bronze and cause the preparation to dry hard; whereas, if this were used for an ultramarine paper, the work would be undoubtedly spoiled.

It is an obvious advantage to make a gold preparation as easy to work as possible, and the key to the guiding principles in this respect must be found in the character of the surface we are printing upon. If it be very hard, the preparation may be thin, but the gold size must predominate; if it be soft, the preparation must be thick and dense, and the gold size should be present only in sufficient quantity to cause the strong varnish to dry within a reasonable time.

Turning our attention to those preparations which are best suited for metal printing, the observations we have made may be applied generally to Dutch metal work; only it is necessary to state further that the preparation used should be such that when the impression is pulled it should present a perfectly flat and smooth appearance. Hence, such preparations which have umber, chrome (unless it be that sort which prints smoothly), or sienna, all of which dry with a rough serrated surface, should be discarded. The best thing to use as an adhesive medium for metal work is a preparation denser than the strongest strong varnish, called melted gum. When this cannot be obtained, the lake or smooth chrome preparation at its greatest strength may be used with success as a substitute.

Dusted Colours are used in printing when it is considered that a printing ink would not adequately exhibit the full strength and beauty of the colour intended to be used. There is no doubt that the slightly yellow tone of most printing varnishes does detract to a certain extent from the pristine beauty of many delicate pigments. There are also a few colours of great beauty, of which it is desirable occasionally to avail ourselves, which are, from their nature, incapable of

assimilation with varnish, so as to make practicable working printing inks. The only way, therefore, by which we can use them is to treat them as we do bronze, and dust them on to the sheet which has been pulled in adhesive varnish.

Many years before ultramarine in the form of printing ink was brought to the state of perfection in which we now see it, the only method by which the printer could avail himself of this brilliant blue was to use it in a powder and dust it on. Even at the present day the most vivid and beautiful green which we possess is so intractable in its character that all efforts to convert it into printing ink have hitherto proved fruitless, and when used, as it occasionally is, for show-card work, the colour is dusted on. There is no doubt that this beautiful green would be very much more largely used in this direction were it not for its deadly character—being made from arsenic. Be that as it may, there is no other method but that of dusting by which we may use emerald green. Even when dealing with ultramarine in its improved state, the effects of the best printing inks made of this pigment are not comparable with those obtained by dusting, and this is especially the case when dealing with large solid tablets.

Nearly all the colours used for dusting purposes require preparation, and some few of the London colour merchants make a speciality of preparing pigments for this purpose. The method of preparation varies: sometimes the pigment is ground in water and evaporated to dryness, but occasionally it is ground in alcohol.

In using dusted colours, success depends upon attention to two main conditions, *viz.*, the paper should be as smooth and highly milled as possible, otherwise the powder may be insinuated into the fibre and the paper will be soiled; and the preparation used should be the strongest melted gum that can be obtained.

CHAPTER LXXXI.

COLOUR PRINTING (*continued*).—How Coloured Pictures are Produced by the Letterpress Process—the Printing of Playing Cards.

WHEN coloured pictures are produced by wood engraving the key block is drawn on wood from the original design and cut by a competent engraver. Then transfers are taken from this key block and set-offs taken and transferred on to as many plain pieces of boxwood as there are to be workings in colour. The artist, with the original design before him, makes up his mind what each colour shall do for the perfect production of the picture. Taking, for instance, the yellow block first, he paints into the key everything he wishes to be produced in the yellow block. Some parts of it will be left absolutely solid, while the other parts which are intended to be more or less toned down will be indicated by an attenuated wash of the same colour. The engraver having these indications to go by, supplemented probably by verbal instructions from the artist, cuts the block. The half and quarter tones are obtained by skilful tinting and cross-hatching. Much of the best colour work done in Germany was in former years produced in this way; but the vast improvement which has recently been made in the production of process blocks is rapidly causing this method to be superseded.

There is a great deal of analogy between the two systems; for while the effects in one are produced by skilful engraving, those in the other are obtained by skilful etching; but in both cases the same high qualities of technical and artistic culture are necessary to get the best results.

In process work the original key is drawn by the artist on a piece of cardboard in black and white. This is then photographed, and a zinc block made therefrom. Before the plate is etched a black stipple is added from a tint-plate. When the key blocks are made impressions are pulled therefrom, and the artist colours them up according to his own idea of what is fitting, and these coloured keys form the originals from which the artist-etchers do their work. Transfers from the key block are taken and set off on (say) four zinc plates, and what was done by the engraver on the wood block has to be done in a different manner by the fine etcher upon the zinc plate. The gradations of tone which are obtained in one case by skilful tinting and cross-hatching are in the case of the zinc plates obtained by a careful sequence of baths, which enables the artist to so etch his plate that he may obtain, in the aggregate, a result which shall as nearly as possible perfectly represent the picture.

Proving.—The complete set of blocks being in our hands for the purposes of proving or printing, a variety of considerations offer themselves as to the best method of performing this function. The primary consideration is to settle whether the key shall be printed first or last—there is much to be said for both sides of the question. If you elect to print the key first, and you have long numbers to do at machine, you spare yourself many anxieties with respect to the register, and this is especially true if you are not absolutely certain of the character of your labour. Much colour printing is done during the night by supplementary hands, and in an imperfect light. In cases like this it is a distinct advantage to print the key first. On the other hand, something of the force and sharpness which the key is intended to give is lost by printing the key first. If, therefore, we are quite sure of the character and competency of our labour, and the conditions are

otherwise favourable, it is perhaps best to print the key last.

When the proving is done with the key first, the whole process is much simpler than when the key is printed last. The key plate is fastened to a mounting board, laid on the bed of a press, and impressions are taken from it on enamelled paper just like any ordinary forme of woodcuts; only, for the purposes of register, it is necessary to fix in the board four points for the registration of the colour plates which would follow, *i.e.*, one point for each colour forme. There is another thing which must be borne in mind in printing the key first. Inasmuch as the subsequent colours are all more or less transparent, the black ink in which the key is printed should contain plenty of driers, and the printed copies of the key should be allowed to become bone dry before the colours are put on.

When the key is printed last, the yellow working is printed first, followed by the flesh, then the red, the blue coming next, and the black last. The yellow being the first working, it becomes necessary to fix firmly four points in the yellow working for the registration of the four subsequent colours; but inasmuch as the second working is a pale flesh, and the yellow does not offer an infallible guide to the register, it is desirable to put the key on second; register it to the yellow, and pull a few register sheets as a guide to prevent any possible risk of bad registration; and it is this complication which renders it undesirable to print the key last. It must be understood that the key, in this case, is only put on tentatively to prevent any mistake in the register.

With these cursory allusions to the method of printing the key last, we now return to the mode of printing the key first, and propose to carry it through in all its details. The making ready of the black would be dealt with in the ordinary way, namely, the plate would be carefully

underlaid, and overlays cut with equal care, so that the black parts of the engraving become firm and brilliant and the light parts soft and delicate. This done, the black may be printed off. This should be perfectly dry before the yellow working is put on.

When there is a suggestion of a water-colour wash in the foregrounds and in the sky tints, the effect is primarily due to the finely-etched grain of the plate; and, secondarily, to extreme care exercised in softening the edges in the making ready.

In preparing the yellow plate for printing, an impression would be pulled for underlaying upon thick plate paper, that is to say, paper which would be about 45 lb. demy. In this sheet the light parts on the edges would be cut away to reduce the pressure, and the solid parts forced by the addition of paper somewhat thinner than the sheet we have pulled. The impression upon this sheet, now dealt with, is pasted under the plate, the printer taking great care to get his underlay in accurate coincidence with the work. He would now pull another sheet, and if necessary treat that in the same way. So far as the underlaying goes, the operation should now be complete. Generally speaking, one thick sheet carefully treated should be sufficient, and hardly ever more than two.

The underlaying being definitely finished, the plate may be fixed on the board by means of eight ordinary $\frac{3}{8}$-inch tacks, two at each corner of the plate. The next process is to make the register. This is done as follows: The printer takes an impression of his black key and finds two places in it at each corner of the sheet which agree with corresponding parts in the yellow plate. These parts may be a scarf or a button. If, for example, there should be a couple of uniforms in the plate with yellow buttons fitting into the key, the printer will cut out in the impression of the key forme he is now dealing with those parts where

the yellow buttons should print. Having done this he will lay the sheet face downward upon the yellow plate, and by means of the holes which he has cut in the key sheet he will find the exact position that the yellow plate should bear to the key plate. This done, the next thing to do is to slightly damp the tympan with some diluted paste, to put the tympan carefully down and take an impression. This will cause the sheet which is on the yellow plate to adhere to the tympan. The next process will be to fix the register points thereon. The printer may make use for this purpose of a pair of the ordinary paste points sold by all printers' brokers at about 1s. per pair, or if he is economically inclined he will find a very excellent substitute in a couple of ordinary drawing pins.

Having selected in the key impression now on his tympan the holes he proposes to use, he should have by him a stick of Prout's elastic glue and fix his points to the tympan by that means, having of course in the first instance placed the spurs of the points through the holes he has elected to use. This done, he is almost ready to take an impression of his yellow forme in yellow ink for the purpose of register; but before doing this there is one precaution he must not omit to take. It will be remembered that the yellow plate is tacked down on a mounting board. If he were to pull a sheet with the points on his tympan as they now are, they would simply become fixed in the board, would be pulled from the tympan, and all his labour would be thrown away. Therefore, before pulling his first register sheet, he must devise some means by which this does not occur. The usual method is this: He takes a little ink (red or yellow) on the top of his palette knife and touches the tips of the points on his tympan with it. Then he gently lowers the tympan until the points with the coloured ink on touch the board. This indicates to him exactly where the points will fall on the board. Then he will get a

punch, or, in the absence of a punch, a large nail, and make two holes in the board at the places indicated by the coloured ink. When his first sheet is pulled the spurs of the points will fall in these holes, and he may proceed to make his register with perfect safety.

Before pulling a sheet for register the printer should get up upon his slab the yellow ink he proposes to use for the yellow working. This may be made with No. 2 chrome reduced with thin or middle varnish, or it may be made with yellow lake, which is a perfectly transparent colour, and a small portion of No. 3 chrome. It must be borne in mind that all yellows made with chrome are more or less opaque, and their transparency when in tint with varnish depends upon the amount of varnish which is used to reduce the body colour of which the chrome colour is made. Yellow lake, on the other hand, is a transparent pigment in itself, and where a black key is printed first it is perhaps better to use a yellow made of this colour.

Having settled the tone and strength of the colour to be used, the next important thing to be done is to see that the slab and roller are absolutely clean; if this is not done very carefully there will be no purity in the yellow, and consequently no brightness in the picture; for not only do we depend upon the cleanliness of the slab and roller to give us pure yellow tones, but the yellow enters into the composition of the greens, which are caused by mingling with portions of the blue plate. The yellow is not unfrequently used as a basis for the strong red which is used in many subjects. For instance, when a vermilion tone is required inclining more to bright scarlet than crimson, the artist would arrange that the yellow should form an underprint upon which the solid vermilion or lake should print. Hence it is of primary importance that the utmost cleanliness should be exercised

in the preparation of everything appertaining to the yellow forme. If the roller which it is intended to use should have been used for any darker colour, it must be washed frequently in turps until every particle of the dark colour has been got rid of. It is, however, infinitely better for the colour printer to keep one or two rollers especially for light tints; and, as these are nearly always transparent tints, they require very fresh rollers made with the old composition, which may be well sponged when necessary, or they may be firm patent rollers, which are naturally fresh and require no sponging.

Bearing all these facts in mind, and having made our ink of yellow lake and No. 3 chrome, we pull a sheet for register. If very great care has been taken, as it ought to have been done, in taking a sheet upon the tympan, the register should come as nearly as possible right; but if any alteration should be needed, the printer may make it in one of two ways, *i.e.*, he may shift the points on his tympan and thus twist the sheet round, so that the yellow falls accurately into the key, or he may leave his points intact and shift the plate upon his board. The latter method is, in the writer's opinion, the most preferable. The way this is done is as follows: When it is necessary to slew or twist a plate round, the tacks which hold the plate at the corners are loosened by prising with a small chisel, the plate is then gently tapped with the hammer in the direction it is necessary to force it, and thus, after one or two essays, the register is finally made.

If the underlaying has been skilfully performed, not much should be left to be done on or inside the tympan, but what little there is to do should be done with great care and judgment. Practically, the printer should only have to get rid of the hard edges, so that the light tones in the foreground and on the edges of the sky are so softened that they go off to nothing. The quickest, and probably

the best way of doing this is to pull an impression upon the thick plate paper we have already mentioned; shave all the edges off by means of a sharp knife or some fine sandpaper; stick the sheet upon the tympan, and the making ready is finished.

Everything that has been written with respect to the preparation of the yellow plate applies to the flesh, red, and blue, which colours are printed in the order given. Each of these will print solid in some places, and in lines more or less close in others, till in places there will be but occasional touches, the intermediate varieties of strength being obtained by the graduated etching of the plates. Each, too, will in places over-print the preceding colours to produce fresh colours or variations of tone. Thus the flesh tint on the black stipple and the yellow will give a copper hue; it will also in places warm the yellow chrome where it over-prints that working alone, the degree being determined by the solidity of the two plates at the points of over-printing. The red will deepen the flesh tints, give orange of varying shades where it over-prints the yellow, and brown of varying intensity where it over-prints the black.

The blue, besides performing its natural function as a blue, has often to perform those generally done by a grey; but it is only by skilful blending of blue, flesh, and yellow that the artist can dispense with a grey working. In judicious conjunction with the flesh, it gives beautiful varieties of purplish-grey; by over-printing the half-tone in the flesh it forms a very pale purple. Several shades of green are obtained by causing it to over-print portions of the yellow plate; while a rich purple is produced by the key in solid and stipple over-printed in great strength by both red and blue.

Playing Cards represent a different phase of printing, for in most pictures the colours are transparent tints, *i.e.*, body colours reduced with varnish; while in the case of the orna-

ments on the back of cards the colours are generally all body colours and opaque. Here the gold may be printed first and the black last. The intermediate tints are represented (say) by a pale blue, a bronze colour, and an opaque red. This sort of colour printing represents one of the most difficult phases of the art. The cards themselves are made—so that they may wear well—of the hardest writing paper; and if the colours were not very stiff, and the printing very carefully done, the result would be washy.

CHAPTER LXXXII.

Colour Printing (*continued*).—Preparation of the Blocks—Proving the Blocks—Multiplying them—Electrotypes.

Preparation of Original Blocks.—There is no subject of greater importance to the colour printer than the skilful and accurate preparation of blocks intended to be used as originals, from which multiples are to be taken by the electrotyping or any other process. Any time spent in the minute elaboration of original blocks is so much saved in all the subsequent processes. So well is this fact understood and acted upon in all large establishments, that no original in the remotest degree defective, either in point of engraving or of register, is ever suffered to be used; and there is no doubt that this is true policy, and in the end a wise economy.

The substances usually used for the production of originals are brass, zinc, wood, and soft metal. All these are used for engraving upon; but, in addition, the zinc is used in producing plates which are bitten out by means of acids. Taking all things into consideration, there is little doubt that brass is the material which gives the best results. When a set of colour blocks is once engraved upon brass and approved, they always afterwards remain in the same condition; they never vary in size, they never warp, shrink, or expand; they are not susceptible to atmospheric influences; or, at all events, this is so slight as to be practically inappreciable. These qualities are priceless when dealing with original colour blocks intended for high-class work, where it is a *sine quâ non* that the register must be absolutely true.

When original register blocks are engraved upon wood, they require as much care as delicate babies. If you have just proved a set and found them all right, and then by any chance happen to place one of them in a damp place or on a damp sheet of paper, it immediately begins to swell larger; a very short time will suffice to increase a wood block 3 × 4 a thick lead all round. If this is not discovered before the blocks are electrotyped, the whole fabric of the design is marred through the electros not registering; and even if it be discovered, it is a troublesome matter to get the block to its proper size. It must be put into a warm place, shrunk back, and re-proved until it fits again.

None of these things ever happen with brass, or indeed with any metal originals. On brass the very finest and most delicate work may be cut with the most satisfactory results. Of course, register blocks frequently are cut on wood; but those who elect to have their original blocks done on this material have to put up with many inconveniences from which brass ones would be free. When large original blocks are required for show-card or tablet work, zinc and soft metal are frequently used. Neither of those substances affords a first-rate printing surface. The zinc affects some colours prejudicially, and the surface of the soft metal interferes with the purity of any tint inks which may be used in printing from it. Therefore, when colour blocks are cut upon either zinc or soft metal, they should be used exclusively as originals from which electrotypes should be taken; and where it is required to print vermilion red from the latter, they should be silver-faced, or the chemical action which takes place between the copper and the vermilion causes the latter to turn black.

Registering: *The Management of Points.*—When a set of colour blocks is received by the printer they require to be proved. In the first place, it is only necessary to prove the blocks for register. A very convenient and effective way of

doing this is to register all the blocks separately into the key. This may be done in the following manner: Take the key or outline block and lock it up in the middle of a chase; if the set of blocks is in six workings, you will require a pair of points of five spurs each (these are usually soldered into small plates of brass or copper), which may be fixed to the furniture at a convenient distance from the block, or may be fastened inside the tympan by means of compo, gum, or paste —the latter is, in the writer's opinion, the better plan, because by adopting this system the holes are made from the back of the sheet, which therefore renders the pointing of the subsequent workings easier and more certain.

The Use of Points.—In all colour printing the exact adjustment of the points is a matter which requires the careful and intelligent attention of the pressman or machine minder. When a mistake has been made, either through carelessness or ignorance, on this matter, the consequences are simply disastrous; it is ten chances to one that the paper used for the first working will be spoiled. A fruitful cause of mischief with the points is the practice which prevails with some inexperienced or careless workmen of fastening points to unprotected pieces of furniture with which the first working is locked up.

For example: we may have to print a couple of octavo blocks in several workings; the first working of these may be imposed in a chase with a piece of double-broad separating the pages. The pressman may thoughtlessly screw or fix his first working points in the middle of this piece of double-broad, and thus run the risk of spoiling his work if the piece of furniture should shift during the progress of the printing.

First working points, whenever it is possible to prevent it, should never be fixed to the surrounding furniture, but to the wood itself upon which the block or blocks are mounted. If there be no other means of securing the points except by fastening them to the furniture, the latter should be so wedged

and secured in the chase that its shifting would be an impossibility. When, however, we elect to fix our first working points within the tympan, instead of to the forme, we get rid of many of the dangers incident to the latter method of procedure. If the points are once firmly gummed, glued, or pasted inside the tympan, the only thing that can affect the register prejudicially is the shifting of the forme itself; and as this cannot happen if it be properly secured, any failure in the registration can only take place through gross ignorance or gross carelessness on the part of the operative. It must be remembered that first working points in colour work are simply marks, which should always be at the same relative distance from any part of the first working. The moment this condition is changed, the most essential necessity of good register is wanting, and we soon find ourselves in a labyrinth from which it is by no means easy to extricate ourselves in safety.

There are certain well-defined conditions which it should be the object of the colour printer to attain in regard to first-working points. The system that offers the most absolute security is that in which the first points are secured to the block itself; when this is done, the risk of shifting is reduced to a minimum. Thus, if we have a forme consisting of four octavo electro plates which are intended to form the first working of a subject in several colours, the most certain way of dealing with them is to have them mounted, with the proper margin between them, upon one board, with the first working points fixed thereto. The adoption of this method minimises the risk, and is a good one to adopt in large establishments where the quality of the labour is unequal, and dependence cannot always be placed on the individual intelligence and care of all the workmen.

The only objection which can be urged against it with any force is that the holes are made in the front of the sheet instead of from the back; consequently, when the second and

other workings come to be printed there is a burr at the back of the sheet, which necessitates greater care in pointing than would be necessary if the holes were made from the back. However, when the points for the first working are fixed to the board itself upon which the plates are mounted, it is scarcely possible for an accident to happen. It does not matter, so far as the register is concerned, if the forme becomes loose and shifts about the table of the press or machine; for the points, being fixed to the board upon which the plates are mounted, shift with the latter and are consequently always at the same relative distance from any part of the plates. The only thing which can possibly cause mischief would be the shifting of the points or plates upon the board, and this can scarcely happen if they are screwed down as they should be. Even if the tympan became loose and shifted backwards and forwards laterally, no harm would accrue to the registration of the subsequent workings, so long as the points and plates on the board were still secure, because the point-holes would still be made at the same distance from any part of the printing surface.

If, however, the points are placed within the tympan, so that the holes may be made from the back of the sheet, very serious mischief would result to the after registration if the tympan became loose so as to allow lateral play. This would not, of course, happen with a competent, careful man, because he would be sure to look to the security of his tympan before starting. When points for first workings are placed within the tympan and the latter shifts, the effect is just the same as if points were fastened to furniture surrounding the forme and the latter moved about during the printing—there would be an ever-varying distance between the points and the plates.

In the establishment of Thos. De la Rue & Co. the system adopted during the writer's time was that of fastening the points to the iron plate upon which the electrotypes were mounted; and the latter were screwed to solid iron

plates and the points were also fixed thereto. Consequently, no mishap ever occurred through the shifting of the points. Therefore, when the work is intended to be printed at machine, this system may always be adopted as the best, because in machine work the pointing of the subsequent workings is invariably done from the front of the sheet, which is the side on which the holes are perforated. In presswork this is different; the holes are there made (when the points are placed in the forme) on the front of the sheet, but the pointing is done from the back, and the objection of the burr remains. This objection is removed when the points are fastened within the tympan, but care must be taken that the forme and tympan are absolutely secure. Having stated the advantages and disadvantages incident to both these systems, we must leave the reader to judge for himself which he elects to use.

Proving the Blocks.—Reverting to the set of blocks which we have to prove: we first of all propose to take the outline or key block and make that—for the purpose of testing the register in this preliminary proving—the first working. This block should be locked up in a chase and firmly secured all round; it is not, as a rule, sufficient to lock it up simply at the tail or side—it should be fastened beyond the possibility of shifting. Then, having levelled it, the points should be fastened within the tympan by new compo or strong paste. The points sold by the printers' brokers are generally soldered into a plate of brass, which is usually somewhat thicker than a thick lead, and are designed for the purpose of being screwed to the mounting board or furniture. This plate of brass is consequently too thick for the purpose we have in view, *viz.*, to paste inside the tympan. Therefore, when it is desired to use points in this way they should be made specially for the purpose, and the spurs should be soldered into thin strips of copper not thicker in substance than a thin lead.

Assuming that points of the right sort have been obtained, they should be pasted on the spur side and pressed through the back part of the front tympan ; a piece of stout, tough paper should be pasted over the back of the copper strip to which the points are soldered, and when this is dry the points may be considered secure. It will be further necessary to fix two narrow thin strips of cork to that part of the mounting board or furniture upon which the points will fall, so that when an impression is taken the descent of the platen will cause the spurs, falling on the strips of cork, to punch a series of clean holes, free from burr, in the back of the sheet.

The points being properly secured, and a careful examination of the tympan made, so as to ascertain that it is perfectly tight without the least play, we next turn our attention to the frisket, which should have been carefully pasted so that it dries flat and free from wrinkles. When the frisket has been cut out, a sufficient number of register sheets should be pulled for the registration of the five other workings to come. As we shall require two sheets of each working in absolutely dead register—so far as the blocks will allow—for the use of the engraver, it will be necessary to pull about twenty-five sheets from the key block. When this is done, the latter may be lifted, the first working points removed from the inside of the tympan, and the second working laid on.

It will be remembered that the purpose of this preliminary registering is merely to test the register, so that no bringing up—beyond merely levelling the block—is necessary. It should also be stated that the key block should be pulled in black or any other dark colour, while it is not material what colours are used for the other workings, so long as they afford a strong contrast to that which is used for printing the key. We may therefore print the other workings in a light blue, pink, or green,

as may be most convenient. Having levelled the second working, it will be necessary, before locking it up, to place a few thin leads and thin cards around it, in case the block requires shifting. When this is done, the block may be locked up, a tympan sheet laid, and the points fixed for the registration of the second working.

The tympan sheet may be laid in either of the following ways: you may lay a white tympan sheet and pull this on the forme after the forme has been rolled and the ink pulled off, thus giving a faint impression of the block thereon, and then take one of the impressions of the key block and find two points in it into which the second working registers. Place a couple of straight pins through these, and pin the sheet to parts which coincide with them in the impression on the tympan sheet: this will afford a guide for the fixing of the second working points. If it be intended to use paste points, they should be pasted at the back and the spurs passed through the two holes intended to be used (which are of course shown in the impression of the outline pinned to the tympan sheet), and thus fastened to the parchment; or if the ordinary screw points are used, fastened by the point screws. The other method of laying the tympan sheet is to take an impression of the outline and cut out two small pieces into which corresponding parts of the second working print; this sheet is then laid upon the forme so that the parts which print into the key show through the holes which have been cut in the sheet. The tympan is then slightly damped and the sheet taken up, and the points are then fastened as in the other case.

A fresh frisket should be pasted for each working. When the frisket has been cut out, a sheet of the outline should be taken and pulled for register. If the tympan sheet has been laid and the points adjusted with care, the second working should not be far out of register. If the

block is found on the first impression not to be quite in register, the forme must be unlocked and the block shifted until it absolutely fits so far as it is capable of doing. A set of colour blocks—no matter how carefully they may have been cut—very rarely fit at a first proving, and the purpose of this proving is to show the engraver those parts which need correction. When all the blocks have been treated in this way, an impression of each, accurately registered to the key block, is sent to the engraver, and when the corrections are made they are returned to the printer to prove for colour and effect.

Multiplying the Blocks.—When original blocks have arrived at this condition, they have reached the stage at which it usually becomes necessary to electrotype them, for except for bookwork plates which contain no cuts stereotyping may be considered almost obsolete.

Stereotyping.—When colour blocks are to be subject only to one working, the stereotyping process is in many instances unobjectionable. If, for instance, we desire to produce multiples of a show-card block which has been cut in one working, where there is consequently no register to make, stereotypes (except for delicate tints) are almost as good as electrotypes. For delicate tints the surface of the stereotype metal is not so good as that given by copper electrotypes. Stereotypes are wholly unsuitable for colour blocks when the subject to be printed is in more than one working, because they shrink so unequally in cooling that they always vary more or less in size; therefore no dependence can be placed on the registration when stereotypes are used.

Sometimes stereos are *faced* with copper, brass, or silver. This copper or brass facing is a distinct process, differing from that of electrotyping, as the latter is understood in the printing business. In the former process the plates themselves are placed in the battery until a thin film of

metal is deposited on their surface; in the latter process the matrix, whether of wax, gutta-percha, or lead, is placed in the battery and the metal precipitated into it. A stereotype which has been copper-faced and a copper electrotype present externally the same appearance; but in the first case, unless the copper-facing has been particularly well done, it is liable to peel off in a skin during the rolling of the forme.

Qualities of Good Electrotypes.—The chief qualities which a good electrotype should possess are that the copper skin should be very hard; that this and the backing metal should be perfectly homogeneous, and that it should be in every particular—especially in point of size—an exact reproduction of the original block. The hardness of the copper skin depends upon the quality of the metal used, while its homogeneousness is in a great measure governed by the rapidity with which the copper deposit is made. If the deposit is allowed to be made too rapidly, there is want of cohesion in the particles, and a brittle electrotype is the result. At Messrs. De la Rue & Co.'s the originals are frequently allowed to remain in the battery for from three to seven days; the growth of the copper skin is slow, but the result is a plate almost as hard and sharp as if it were cut in brass.

There are few colour printers who have not at one time or another experienced disappointment at the faulty registration of their electrotypes. Of course this has nothing at all to do with the electrotyping process, if the original blocks themselves do not fit; but it not unfrequently happens that the original blocks register accurately, although the electros taken from them do not, and it is to this point that we wish to direct particular attention.

Wax is the material commonly used to form the matrices in electrotyping colour blocks. This substance is more or less affected by atmospheric conditions. In a very cold temperature it shrinks, in cooling, more than it does in a

warmer atmosphere. If, therefore, we have a set of blocks in six printings, and three of them are moulded on one day and three on another, it is a mere chance if the whole register accurately. The difference in the temperature will probably cause a difference in the size, and this difference will be marked in the same ratio as the variation in the temperature at the time of the respective mouldings. The practical inference to be drawn from these facts is that the whole of the original blocks of any one subject should be sent to the electrotyper together, and these should be moulded at one and the same time.

The Mounting of Blocks.—In printing from electrotypes the material to be used in mounting them is an important consideration. There is no doubt that the very best substance for the purpose is an iron plate. When wood is used for heavy work requiring much impression, the fibre of the wood becomes compressed and the impression yields. Machine minders who have had to do with cut work, where the solid parts of the engraving have been heavily overlaid, often find the wood upon which the electrotype has been mounted sunk as much as a thick lead. When this is liable to happen, the impression cannot be firm and solid. It is therefore important to choose a material which shall be as unyielding as possible. Mahogany is generally used; walnut-wood is preferable to it, but iron is the best of all.

Reproduction by Photography.—Multiples of register blocks may be made by means of photography, in increased or diminished size. Thus, for example, a set of blocks six inches by four may, by this process, be accurately reproduced three by two or twelve by eight inches. It must, however, be borne in mind that where the electros are increased in size any defects the original blocks may possess are magnified, while the converse of this is true if the electros taken from them are diminished.

A Substitute for Silver-facing.—There is one other observation to make before quitting this subject. In our remarks on colours it has been stated that when it is required to print vermilion red from electrotypes they should be silver-faced. This is an expensive process, and the writer therefore offers the following suggestion as a substitute, which may be applied with success in a great many cases. The object in view in silver-facing electrotypes is to prevent the chemical action of the copper from disorganising the vermilion, thus making it print a dirty brown instead of a bright red. It follows therefore that if we can give the electrotype a coating of something which shall prevent the chemical action from taking place, it will answer the same purpose as the silver-facing. The substitute we suggest is not suitable for very long numbers or for fine engravings, but for solid tablets, for show cards, or for any short number, say 500 or 1,000 pulls, where the forme is of such a character that it does not require much washing up, it will be found an admirable substitute for the costly silver-facing.

Suppose we have the first working of a show card to print in vermilion from a copper electrotype. Instead of having this silver-faced, take one ounce of Winstone's gold size, and grind up with it a quarter of an ounce of the "lake brilliant" of Cornelissen. Roll the electrotype with this preparation and allow it to remain for twelve hours, by which time it will be as hard as stone, and the vermilion red may be printed from the plate without the smallest diminution in its brilliancy.

Storage of Plates.—When out of use electrotypes should be kept in a dry place, and the surface of the plates oiled, to prevent verdigris. When electrotypes become clogged with hard, dry ink, which the pick-brush and turps fail to remove, they may be cleaned and made equal to new in five minutes by covering their surface with a little creosote, and afterwards brushing the face out with turps.

CHAPTER LXXXIII.

Colour Printing (*continued*).—Printing from the Blocks—Choice of Hand Press or Machine—Colour Printing at the Hand Press.

Our blocks being now in order we are to prepare to print from them, and the question arises whether we shall use a machine or a hand press. For long numbers there can be but one answer: a machine is imperative unless price be no object, and for comparatively short numbers a treadle platen may be used. But where the very best work is required or where the numbers are sufficiently short to admit of it, the hand press is to be preferred. We say the best work is done at the hand press because, as we have already pointed out, the best inks are those made with the stiffest varnish, and very stiff coloured inks cannot be relied on to work with at machine, and again each impression is under the immediate control of the pressman, who can influence it by his personality in a way that cannot be done at machine. We will therefore first consider the working off of a colour job at press.

In the writer's opinion the Albion press is far the best for all purposes, and we shall assume that it is a press of this kind which is to be used. We shall take for granted that the reader has a thorough acquaintance with its working parts and with all that has been stated in former chapters as to the essentials for good work, and that if such a thing as a crease or buckle or slur should occur he will, by the instruction already given him, know what steps to take to remedy it. Assuming, then, that the press has been properly cleaned and scrutinised, that it is quite rigid and free from even the

suspicion of a shake, it is ready to receive the first forme. Before laying this on in order to make it ready, however, it will be appropriate to state at this point the sequence of the various processes which enter into the preparation of colour formes for printing. These are as follows:—

1. The forme has to be underlaid.
2. The points have to be fixed in their proper place.
3. The register is to be made.
4. The bringing up is to be done.
5. The roller is to be chosen and the colour matched.

The Impression: Hard or Soft Packing.—As colour blocks vary very much in the area they present for printing, that is an element which must be borne in mind in determining the sort of impression they shall be worked with. Some formes would be very heavy and nearly solid all over; others might be very light and only contain a few dashes of colour here and there. It is obvious that the sort of impression which would be suitable for the solid, heavy forme would be unsuitable for the light, open one. In the first case, it might be necessary to put a blanket inside the tympan; while in the latter a thin card would possibly be the best thing with which to work the job. The question as to whether it is better to use a hard or a soft impression is not one that can be settled dogmatically in favour of either one or the other of these systems; it must be determined by the character of the particular forme to be dealt with.

There is also another circumstance which will influence our judgment in deciding whether the impression shall be a hard or a soft one, and that is the nature of the material to be printed upon. Sometimes the colour printer may have to deal with a very hard, unyielding card, not too smooth on the surface; while at another he may have to use a smooth, soft, well-glazed paper, and this may happen on the same forme.

Suppose, for example, that we have a show card to print, of which the first working is a solid white letter block, from

which half the number is to be printed on a thick, hard card and half on smooth, soft paper. In making ready this forme for the cards, it would probably be necessary to use a blanket inside the tympan with a thick overlay—the whites being cut out—behind the blanket, so that the blanket itself and not the overlay comes next the card, with only the parchment of the tympan intervening. This would give us the best chance of forcing the hard card into the surface of the plate, thus producing a solid, firm impression. The thick overlay behind the blanket would further assist us, and the very toughness of the card itself would prevent the impression dipping into those parts of the block which have been cut away. When, however, we come to print the soft, thin paper, the conditions are wholly changed, and a modification must be made in the character of the impression. If we pull an impression on the paper, we shall find that the softness of the blanket will force the paper into whites, thus causing a want of sharpness in the outline; whilst the bulging of the paper would be liable to interfere with the registration of the next working. In a case like this, the impression should be made harder, the blanket may be removed, and a dozen sheets of the thin double crown used in most offices substituted. If the dip still continues and the impression is not perfectly flat, the overlay may be put on the tympan which is next the forme. If this sort of hard impression had been used for the cards, it would have been extremely difficult to have got the forme solid, and then only with great power and a possible risk of breaking the press.

The general deduction to be drawn from the foregoing is, that when the block or forme to be dealt with is nearly solid all over, with few whites therein, and a card exceeding the thickness of a four-sheet board is to be printed from it, it would always be right to put a blanket in the tympan. If we had to print a perfectly solid flat tint a blanket would be the best thing with which to work it, whether paper or card

were used in printing from it, the only disadvantage arising from a blanket impression being the dip which would occur round the edges, and which would have to be controlled by a thick overlay cut to the exact size of the plate. When it is deemed expedient to use a blanket for colour blocks, it should not be a thick one. A piece of fine white Saxony wool cloth is the most suitable, or, at all events, it should not be thicker than the description known in the trade as fine Napier.

The cases, however, in which it is desirable to make use of a blanket impression are comparatively rare, and may be said to be confined to very solid formes which are printed on hard cardboard. In dealing with ordinary formes printed on paper, or thin, smooth card, thin double crown will generally answer every purpose, and the number of sheets suitable for putting inside the tympan must be governed by the open or solid character of the forme to be treated. If the forme be a very light, open one, a few sheets only, say eight or ten, of thin double crown would be sufficient. If, on the contrary, it is a full solid one, twenty-five to thirty may not be found too many. There are, however, instances in which the impression given by the limited number of sheets we have just named may be found too soft.

Besides dealing with formes of blocks of various degrees of openness, the colour printer has frequently to print a border of a single line either in gold or colour. In such cases, in order to ensure great sharpness and flatness in the impression, it may be necessary to discard paper inside the tympan altogether and use a glazeboard or thin ivory card. Sometimes title pages in expensive books are printed in red and black, the brass rule border and a few of the salient lines being in red. In this and similar cases it would be best to use a thin card inside the tympan, because the hard impression, by preventing all "dipping," would give us the best chance of producing a sharp, clean impression. Again, supposing

we have a forme of solid borders to be printed in gold, the gold line being about a nonpareil wide; in this and analogous cases the object of the printer is to get his impression as firm and as flat as possible. Paper, therefore, or any other soft material, inside his tympan would cause the impression to dip at the edges; so that a card would be the best thing with which to work it. The colour printer, in determining the character of his impression, should do so with the endeavour to emulate the firmness, flatness, and softness of lithography.

Making up the Forme.—We left the press prepared to receive the forme, which for our present purpose may be supposed to be of a simple and elementary character. For the sake of illustration, we will assume that 4,000 small show cards are required, and that it has been determined to print them four-set, either mounted upon a foolscap mounting board, or mounted separately and imposed in a chase; it must be further assumed that the show card is in two workings, of which one, the first, will be a solid white letter block, while the second working will consist of the shading only to print round this lettering.

In some offices a set of this description would be made up in the composing room, but it is frequently expected in colour houses that the pressman shall be competent to make up his own blocks. Assuming that the latter is the case, he would first procure a foolscap chase, put one of his blocks in each quarto, and place the necessary furniture and quoins around them. Then, having procured a sheet of the card intended to be used, he would have to consider, before making his blocks up, the question where his first working points should be placed.

It may be that the cards are sent in trimmed, so that if the blocks were made up out and out, one cut in the middle each way would give the exact margin. In this case the points would have to be placed *exactly* in the middle of the gutters, either at the top and bottom or on

the short cross, so that when the cards were cut up the knife would divide the holes made by the points. This might not be objectionable for common work, but it undoubtedly would be for work of a high character, in which case an additional thick lead should be placed in each of the gutters, which would give a nonpareil extra for the points to fall into, so that they might be cut out altogether when the cards were cut up. It would, however, be a mistake to give the pressman cardboards to print cut to the exact size; there should always be sufficient space left beyond the limit of the margin necessary for the card itself, for the points to print on. When this is so, the pressman would only need to get the exact size it is intended to cut the card to, make up and carefully straight-edge his forme to this, and fix his points beyond the limit of the outside margin of the card. Thus, in the forme we are dealing with, if half an inch margin were required round each card, an inch of space would of course be left in the gutters, while another inch should be left on the outside; half an inch for the margin of the card, and half an inch for the point-holes, which would be cut off. In making up his forme the pressman must therefore be guided by his point-holes and their relation to the boards he may have to print. Assuming that he had satisfied himself in this respect, he would now turn his attention to adjusting his impression, with the view of underlaying the forme.

Making Ready.—In underlaying block formes which have to be printed on cardboard, this part of the making ready should be done with great thoroughness. The object we have in view in underlaying our blocks is two-fold—it is not necessary merely as a means of levelling the impression, because this might be done, however improperly, by overlaying; but it is essentially important that the blocks should be made perfectly level by underlaying, because if this is not done the blocks of which the forme consists vary in

height, and thus prevent the effective rolling of the forme. The amount of underlaying which electro blocks require depends greatly upon the even thickness of the mounting boards and the plates themselves. Some electrotypers merely turn the backs of the plates, while others plane them; the latter is the method which gives the most satisfactory results.

Before pulling a sheet for the purpose of underlaying, the reader may be reminded that we are now dealing with four white-letter blocks mounted separately, and fastened to the board by means of screws. Having inked our roller—any colour will do for the purpose of making ready—we roll the forme and pull a sheet for the purpose of testing the impression. The sheet thus pulled should be examined on the back. If there be too little pressure, the impression on the back of the sheet will be scarcely visible except in those parts of the plates which are unequally thick. If, on the contrary, there be too much, the thick parts of the plates may print so strongly as to nearly burst the paper. The intelligent pressman would, in adjusting the necessary pressure, take the mean of these two effects; but in underlaying plates it should always be borne in mind that it is much easier to bring up a low part by underlaying than it is to reduce a hard one. If, for example, one corner of a plate prints very strongly, and another corner lightly, you have only a choice of two things in levelling it, *i.e.*, you must scrape away the bottom of the plate where the heavy impression occurs, or you must bring up the light part of the plate to the impression of the heavy part, and, in practice, the latter is the easier method. Therefore, in assessing the amount of pressure with which we will begin to make ready the forme, we must be mainly guided by those parts which print the strongest—the pressure should be sufficient to make these print fairly well, and the light parts should be brought up to them,

The impression being adjusted, a sheet of rather stout paper should be chosen—about a 30 lb. demy would do—and another impression pulled. This sheet should be pasted or pinned in the margin to a board slanted at such an angle that when the light falls on the sheet it brings out all defects of the impression. The pressman is now ready to level the sheet; but before he begins he must settle in his mind whether he shall place his underlays at the bottom of the mounting boards, or unscrew the plates and paste his underlays to the back of the plates themselves. In determining this question the pressman would probably receive his cue from the employer or overseer; for if the job were one which the exigencies of a cutting trade required to be done quickly without much regard to quality, he would undoubtedly elect to underlay the blocks without removing the plates; but if, on the contrary, careful work of high character were required the proper way would be to unscrew the plates and underlay them.

It may, however, be not amiss here to briefly sketch the difference in treatment between high-class and low-class work of this character; for in these days of keen competition the competent operative should be capable of grappling with both.

Quick Mode.—Supposing, then, quantity and not quality to be the desideratum, the pressman would obtain thick brown paper or thin wrapper; and, glancing at the sheet before him, his trained eye would take in at once the inequalities of the impression. Bearing in mind the fact that the underlay he is making is to go underneath the board, he would take no notice of local defects in individual plates, but confine himself to the endeavour to make every plate relatively equal in impression. Perhaps on the first sheet he may have to place three thicknesses—to use an expressive word known to block printers—of wrapper under one of the blocks; two under another, possibly leaving out

a hard printing corner in each; the third block may only require a piece of wrapper on one side; and the fourth may be sufficiently level to be let alone. Having thus rapidly gone over the sheet on the back, which should not occupy longer than ten or fifteen minutes, the pressman turns the sheet over on its face, and proceeds to cut the pages up close to the printed boundary line of each block.

Beginning with the left hand top corner, he cuts out the underlaid impression of this block and places it, face downwards, on the corresponding block in the forme; then, having dealt with the other pages in a similar way, he unlocks the forme all round, takes each block out separately to prevent mistakes, and pastes the underlay, printed side outwards, to the bottom of the block.

The blocks in each quarto should now be tightened by pressing the quoins with the thumb, a sheet of waste laid on the forme and the platen pulled down on it several times to get the blocks firmly on their feet. When this is done the forme should be again rolled, and another impression pulled. Possibly, if the first sheet has been underlaid with great judgment, the blocks may all be equally level; if not, the second sheet must be treated in exactly the same way as the first: this will probably be found sufficient, although in extreme cases a third one may prove necessary. The underlaying may now be considered completed.

The pressman would next pull a sheet for overlaying, so as to correct any local failing of the impression in individual plates. In doing this he should choose a thinner paper than that used for underlaying; say, a 20 lb. demy. Having pulled the sheet he should, before he begins to bring it up, lay his tympan sheet. This should be cut to the size of the card he has to print, folded into 4to, damped all over with a sponge, and pasted on the damp side all round the edges,

The sheet is then laid on the forme, so that the crease exactly divides the margin. The tympan is next let down and pulled very slightly, just sufficient to cause the damp sheet to adhere to it, and is then raised, and the bottom part of the tympan sheet pulled away from the parchment and pressed perfectly smooth with the hand, so as to exclude all air. The top half being treated in the same manner, it may be left to dry—which it should do quite flat—pending the bringing up of the sheet which has been already pulled. In printing white-letter blocks care must be taken not to pull a damp tympan sheet too soon after it is laid, or the wording will be embossed on the damp parchment, thus causing the impression to dip when the cards come to be printed.

Proceeding with the bringing up of the sheet, the pressman again has recourse to the slanting board. Examining his sheet on the back, he might, if the local defects were very strongly marked, bring this sheet up in the same way as he has done the sheets already treated; but the bringing up of white-letter tablets is not like bringing up so many pages of type. If, therefore, the underlaying has been effectively done, he may have some difficulty in discerning the weak parts of the impression when examined from the back part of the sheet. When a doubt of this sort enters his mind he should at once turn the sheet over on its face and bring it up by filling in the light parts with a paper equal to a 12 lb. or 14 lb. demy: the weakest parts of the impression will probably require three thicknesses of this to make them level.

When brought up, the sheet should be pasted to the inner tympan, so that the sheets or blanket with which the job is worked intervene between it and the forme. This is done so that the effect of the pieces used in levelling the sheet may be less abrupt than it would be if the sheet were fastened to the parchment which is

next the forme. The sheet would of course be fixed in its proper position in relation to the forme by means of pin-holes made through the back of the tympan, in the method fully described previously; but it is necessary to mention that before pulling a sheet for bringing up "over," a sheet of white paper may be pasted on the inside of the inner tympan. When this is done there is never any difficulty in finding the pin-holes; while if it is not done, it is always a troublesome and frequently a doubtful matter to find them in the parchment itself.

By this time, also, the tympan sheet should have dried hard and flat, and the making ready may be considered sufficiently complete to justify the printer in pulling a card in the colour intended to be used in printing the job. The preparation of a forme of this character—after the blocks are made up—should not occupy more than an hour and a half or two hours.

It will be noted that in this method of treatment there is no attempt at elaboration; no overlay has been cut out—the forme has been simply levelled by two or three sheets placed underneath and one over.

Better Mode.—We will now proceed to notice the other and, it must be admitted, better method of treatment.

Going back to the point where the pressman has pulled his first sheet for underlaying, he provides himself with some thinner paper than he would use for underlaying the blocks—some of the 30 lb. demy he has pulled his sheet on would do very well. He levels the sheet on the back in the way he did in the first instance, but less heavily and with more care. Should any of the plates be extra thick in parts, thus causing the impression to be very hard, these parts may be reduced by filing with a flat, rough file, or, if this be not at hand, a piece of broken glass may be used as a substitute. Having pasted the underlays to the bottom of the plates, taking care that the paste is not put on

too thickly, the plates should be carefully placed over the screw-holes, the impression pulled down and another sheet pulled. This second sheet should be thinner than that first used, which will enable the printer to see more distinctly the impression on the back, and the local defects may also be further corrected by pasting small pieces of paper on to those parts of the face of the impression which print very lightly. This second sheet should, in the majority of cases, be found sufficient; but before screwing the plates down the printer will do well to take one of the cards intended to be used for the job, roll his forme, lay a sheet of paper on the plates, place this card on the top of it, and thus pull the sheet; first taking off some pressure, to allow for the thickness of the card.

The impression thus pulled will enable him to form an accurate idea of the condition of the impression in relation to the card upon which he has to print. This sheet should be examined, and any defects it exhibits should be corrected by pasting pieces of thin paper to any parts of the plates which still present appearances of weakness in the impression; and this process of pulling a sheet with a card on the top should be repeated until the impression is thoroughly sound and firm all over. When this point is reached the plates may be screwed down.

This system of underlaying necessarily occupies more time than that first described, but it is very much more thorough—especially so if the blocks are mounted all on one board; for in that case they are always in the same relative position, and in case of a reprint, if the overlay is preserved, the forme is practically ready to be worked off.

There is another advantage which the system of underlaying the plates has over that of underlaying the blocks: the underlays are always secure and never get knocked off or lost, as is frequently the case when they are pasted to the bottom of the mounting boards.

Following up the process of making ready with the same thoroughness with which it has been initiated, the pressman takes another sheet of the 30 lb. demy, and, rolling his forme, takes an impression. Before raising his tympan he pierces two holes in the margin through the back of the tympan and the sheet on the forme; then he pulls another sheet on the same paper, but does not make the holes through it as in the first instance. This last sheet is intended to form the overlay, while the first one is to be used to paste the other on it. The next step is to make the overlay.

The objects to be aimed at in printing white-letter tablets are, so far as the bringing-up is concerned, very simple. The tablet should be perfectly firm and solid all over, so that it will print full and deep in colour without an excessive quantity of ink, while the curves and outlines of the letters should be sharp, clean, and free from dip or burr. We shall be assisted in obtaining these results by a carefully cut-out overlay. The pressman should therefore have the sheet pulled for the purpose, and cut out the white parts of all the wording, leaving nothing but the skeleton of the tablet in each of the four cases. These should then be pasted to the sheet with the pin-holes in it and fixed in proper position, by means of two pins, to the parchment which is next the forme.

If the tympan sheet has been laid, as it should have been, before the overlay was cut out, it will now be perfectly dry, and all that remains to be done is to get three pins, one to stick at the bottom of the tympan sheet, and the two others in the offside edge, so as to support the card on the tympan.

If the frisket is now cut out, the preparation of the forme has reached the stage at which the pressman must think of the choice of a roller, the thorough cleaning up of his forme and slab, and the preparation of the colour

in which the forme is to be worked. Before doing this and committing himself to the printing of the cards, he may not unprofitably review mentally what he has already done, by asking himself firstly—Is the margin correct? Are the points in their proper position, is their perforation complete, and are they perfectly secure? Is the tympan quite tight, and are there any "bites" in the frisket? If these questions can be answered satisfactorily, he may safely proceed to the next step in the process.

The forme we have just dealt with may be accepted as a type of all tablet work at press, so far as relates to the making ready.

Choice of a Roller.—We have now to consider the choice of a roller and the preparation of the ink; and in this latter respect it will only be necessary to refer to Chapter LXXVIII. in which the subject of inks is dealt with, to find the precise thing necessary for our present purpose. The sort of roller required is suggested by the forme itself. In the first place, we do not require so good a roller as we should if we were dealing with a forme of solid woodcuts, containing masses of light and shade and much fine engraving. It will be noted that the tablet forme contains no fine engraving—there is scarcely anything in it to keep clear and prevent filling up. A roller, therefore, which is well matured and very firm would be the best for the purpose we have in view; one about a fortnight old, and inclining more to hardness than to softness, would answer the purpose best. In dealing with solid cuts, or with solid tablets printed in black, the objects aimed at generally are to get the maximum of depth and intensity with the minimum of ink, and this result is obtained by using a good dense black, and rolling the forme thoroughly well.

Although this is sufficient for subjects printed in black, it would, in the writer's opinion, be a mistake to apply the same principle to solid subjects printed in colour. It

should be borne in mind that black ink is the densest we have, and that the thinnest possible covering is sufficient to blot out the paper. This is not sufficient in solid tablet work printed in colours, the densest of which are less opaque than black; while some of the paler tones would look quite washed out and impoverished if the forme were only kept just full enough to conceal the paper. If this reasoning is correct, it follows, therefore, that tablet work should always be kept full, and this is especially the case with those colours which are themselves remarkable for possessing little body, such, for instance, as the purples made from aniline. There is of course a limit to the quantity of ink proper to be kept on a forme of this description, and when this limit is exceeded, it is at once shown by the absence of sharpness in the outline of the letters.

For white-letter tablet formes, which do not contain any fine engraving, a well-matured roller, free from damp, may generally be chosen. If the tablet contains any fine work, a newer and softer roller must be chosen, with the view of keeping the fine work in the engraving clean. Some colours require rollers which would be wholly unsuitable for others. For instance, browns made from sienna and umber require fresh, new rollers, because these pigments dry so rapidly that the rollers used quickly "go off" and become dry on the surface. Vermilion, on the contrary, requires a very dry roller, no matter what sort of work it may be used for. Chinese blue and carmine require fresh, good rollers, and so do the green lakes. In printing rule work, care should be taken that the rollers are not too damp, or the work will be wiped.

Managing the Ink and Rollers.—In dealing with large solid formes, especially if stiff ink be used, in the winter time it is frequently a matter of great difficulty to get into work, both at press and machine. Nor is the difficulty of

working very large blocks confined to the cold weather. It is true that automatic brakes have been applied to some of the machines used for this kind of work, which have the effect of easing the cylinder over the impression, thus pulling the sheet gently from the forme. But if it is desired to print the ink at its fullest strength from the largest formes, the machines and presses should be fitted with apparatus for imparting heat, when all difficulties of this sort vanish.

This softening of the colour by means of heat is in every way preferable to reducing the ink with thin varnish or lowering oil, which impoverishes it. It is not at all times possible to avail ourselves of heat, no matter how desirable it may be to make use of it. For example, we may have got fairly into work with a solid forme containing some fine work, printed in a bright light blue (made with ultramarine and white), and for which we should require a tolerably good roller. Assuming that we leave this all right on a Saturday, and that a severe frost occurs between Saturday and Monday morning, we should probably find that the roller had become so hard as to be useless, and that the ink had become set and putty-like from the action of the cold. In the absence of appliances to furnish heat to the slab, it would be necessary, in a case like this, to reduce the ink with a small quantity of thin varnish, and regrind it with this, at the same time adding a small quantity of pure ultramarine ink to compensate for the diminution in body caused by adding the thin varnish.

It sometimes happens during a continuance of wet weather that all the rollers in an office become very damp. A most effective way of dealing with rollers in this condition is to wash them in turps, and wrap them up in blankets which have been made warm. When rollers become very hard and skinny in cold weather, they may be washed in hot water, which will soften them and give them a new face.

In country or small offices, where the supply of rollers is small and the choice limited, and where, therefore, it is not always possible to get a roller to suit the ink, the latter may be modified to suit the roller. Thus, if the rollers are hard and not sharp, some strong varnish may be added to the ink with advantage; while if the rollers are fresh and damp, and do not take up the ink at its normal strength, this treatment must be reversed and thin varnish added. New, soft rollers are, as a rule, not suitable for gold preparations, except in the case of preparations made from sienna or umber, for which fresh rollers are best; because these pigments dry so quickly that unless the roller used be very fresh, it soon goes off.

Assuming that the first working of the show-card forme we have been discussing is to be printed in four different colours, *viz.*, light blue, light green, light purple, and gloss red, a reference to previous pages would tell us that the basis of the light colours would be white ink, of which we have already treated, that is to say, it would consist of flake white ground stiff in middle varnish. A small quantity of either ultramarine or Chinese blue should be added to the white, according to the tone of blue required, the ultramarine looking best by daylight, and the Chinese best by artificial light. For the green, a small quantity of deep blue-green lake should be added to the white; but if a light green of a yellow tone is wanted, the white must be discarded altogether, and the colour made of lemon chrome and a little Chinese blue, or with the palest shade of drop green lake. The purple must be made with white ink and purple lake, while the gloss red may be made with lake brilliant ground in thick middle varnish. This colour will not be absorbed into the card, but will gloss as it dries.

The main things to be aimed at in tablet work are to get the colours as solid and rich as possible. The richness depends upon the amount of body in the ink, and

the solidity depends upon perfect making ready and the thorough clearing of the forme at each impression. If the ink does not clear the forme, it is shown by the "motley" appearance of the printing. Should this happen, it must be controlled by the addition of a little soap or strong varnish.

Making Ready the Second Forme.—Turning to the second working, which would be printed in black, and would only consist of the black shading to the lettering, it is only necessary to observe that the blocks would be registered in the way already described in detail, but it will be necessary to change the sheets or blanket we may have inside the tympan, and substitute therefor a thin card and a few sheets of thin paper. This is done with the view of preventing the dipping of those parts of the shades where they come to a point. These should be all carefully cut away in the making ready, and, if time be not an objection, the work would be all the better if an overlay were cut out for them.

CHAPTER LXXXIV.

COLOUR PRINTING (*continued*).—Overlays.

Overlays.—The preparation of overlays for block colour printing, no less than for black cut work, is an important factor in faithfully reproducing the effect obtained by the artist in his original drawing; only in the case of subjects treated in colour the matter is obviously more complicated than it is in ordinary black cut work, where the printer has but to imitate the effect produced and exhibited by the engraver's india proof. In doing this he has to deal only with one block, in which are contained all the effects of light, shade, and perspective which are produced by gradations of tone in the engraving. In coloured subjects, although the same principles apply generally, yet they are so far modified that many tones of colour enter into the composition and are used in working up the general effect of the picture.

In black cut work the printer has always the cumulative result of his labour before him. In coloured subjects the effect is built up by a succession of impressions in various colours, upon the careful treatment of each of which the ultimate result depends. In black cut work, where the printer has the engraver's india proof to guide him, he may correct his treatment of the making ready as he goes on, because he may compare the strength of every part of his impression with the proof before him; while in colour work he must judge of the strength or weakness

of his making ready, not only by the appearance of the impression before him, but by the modifications which will be effected when the subsequent workings are printed. A little deviation from truth in the strength of a colour, or undue hardness in the impression of any of the workings, may be sufficient to distort the perspective and damage the final effect when all the colours are put in.

The method of preparing overlays for colour printing does not materially differ from that adopted in ordinary cut work; the outline block, or last printing, in most colour subjects is in fact a cut which contains all the work in a reduced or skeleton form, as if it were to be printed in one colour.

A well-printed engraving, when thoroughly made ready, should be perfectly flat; there should be no part of it dipping; the light parts should be so softened off that they just print and no more, while the solids should be made absolutely firm. It should be borne in mind that every line in an engraving is intended to print at its exact strength. Therefore, on the one hand, the lights should not be softened so much that they are broken or "rotten," as it is technically termed; nor, on the other hand, should the impression be left so hard that any line prints thicker than is shown in the block itself. In colour blocks where the subject is divided into many colours there must necessarily be large spaces of white in the various blocks; and if proper care be not taken both in the adjustment of the impression and the preparation of the overlays these whites are liable to dip to such an extent as to cause the registration to be faulty.

In order to avoid this, and get the impression as flat as possible, colour formes should be made ready with a very light impression. Then, as the solids are gradually overlaid, they have the effect of bearing off and throwing back the lights, so that it is only necessary generally

to cut these away at the edges where any symptoms of dipping are apparent.

In dealing with colour blocks to be worked on dry rolled paper, as is nearly always the case, it is best to paste the extreme solids first on to the sheet, so that the general and intermediate overlays which are pasted on afterwards intervene between them and the forme and so soften their effect.

It is a good plan, in bringing up colour blocks, to use black ink in the process of making ready, because good bookwork black prints better, as a rule, than do most coloured inks. Therefore, if the making ready appears perfect in an impression pulled in black, any imperfection shown when its own colour is used may be safely attributed to the imperfect furnishing of the ink.

The cardinal rule to be observed in the preparation of colour blocks is to avoid all hardness in the impression; it is only by attention to this that the chromo-typographer can hope to compete with his formidable rival, the lithographer. Every succeeding tone of colour should be made to blend with the preceding one, and this result is attained by skilful treatment in the making ready, as well as by a complete agreement of the tones of colour used.

We will endeavour to illustrate this by a few examples. If we take a woodcut engraved to print in one colour—say, for example, of a rose, in which all the work is in the block—we get a more or less faithful reproduction of the form of the flower when the block has been properly overlaid and brought up. If, however, it be intended to produce the same thing in colour, at least two, and possibly three pink blocks would be necessary for the effective bringing out of the flower; while a pale yellow and two green blocks would be required for the reproduction of the leaves and stems. What is given in the first place solely by gradations of tone in the engraving is in the

case we are now discussing produced by graduated tones of colour, printing one on the top of the other. In order to produce a true and artistic effect, two things are necessary —first, that the colours themselves should be appropriate in strength and tone, and, secondly, that the making ready should be of the exact strength to cause these tones to blend without undue hardness.

In a set of blocks of this character the yellow working would be a solid flat block (possibly containing a few lights), embracing all the leaves and stems, and in this instance all that the printer need do is to get his impression very firm without the least dipping round the edges. A block of this sort should be made ready as flat as if it were lithographed.

The preparation of the overlay would be very simple, and would consist of only one thickness of paper, because there would be no variety of tone in the engraving for the printer to bring out. He would simply have to pull two pieces of paper, of which the first would be pricked to go inside the tympan, while the second would be used to make the overlay. This would have to be cut close round the edge of every part of the impression and pasted—taking care that the paste is put on very thinly—exactly on to the impression of the first sheet, which would then be placed inside the tympan.

It is of course a matter of extreme importance that the overlay should exactly coincide with the block. If an overlay is not on the block properly, the impression at once shows where it is off, and it must be shifted until it fits the block exactly. On pulling another sheet it should be found that the impression is fairly sound, and that the effect of the overlay has removed most, if not all, of the dips round the edges. If it has not, another sheet should be pulled, and treated in the same manner; only in the second instance it will not be necessary to use such thick paper as was required in the first case.

A couple of sheets thus overlaid should be sufficient for the bringing up of a block of this character; but if any of the edges still dip, they must be cut away in another sheet until the impression is perfectly flat. A good way to test the completeness of the making ready is to pull an impression in black ink on the paper intended to be used. If the block is quite solid and well covered with a fair quantity of ink only, and it shows no signs of dipping round the edges when examined on the back, the bringing up may be considered done.

The second working would be the first tone of green. This would cover up the whole of the stems and all the leaves, except those parts where the full lights were left in the engraving. In making an overlay for a block of this description, where we have only to make sure that those parts which are graduated in the engraving are sufficiently soft, it will not be necessary to use more than two thicknesses of thin paper.

On pulling an impression of this green working it would be found to print almost entirely over the yellow block, except where it would be cut away in the leaves on either side of the central fibre to create the lights, and it is to this point in work of this character that the printer should direct his attention. These lights would start from the solid parts of the green block at the base of the leaves, and would gradually widen until the yellow first working was allowed to burst through it.

Now, if these and similar effects in colour blocks are not properly treated in the making ready, the whole effect is spoiled. Every succeeding tone of colour put in by block after block should be an imitation, as far as possible, of the effect which would be produced by the brush in painting. In the green block we are dealing with, the effect obtained in painting by a number of lines softening off to nothing is imitated by similar lines cut in the block; but if these

are left too hard in the impression no artistic effect is produced. And all that has been observed respecting the first green block is equally true respecting the second, which would be of a deeper tone than the first, but there would be no abrupt contrast in the colours. This block would be softened off at the edges in the engraving, so that the tone of one colour gradually merged into that of the preceding one. This, however, is never the case unless the overlaying is skilfully treated.

Two tones of colour like these should so blend with each other that the line which separates the blocks should not be visible. If the impression of the second green block were left hard on the edges, the result of the engraver's art would be thrown away, because, instead of a soft blending of the colours, we should get a hard line and a strong contrast between them. In all those cases, therefore, where tones of colour fall on and merge into each other, the preparation of the overlays should be an imitation of the preparation of the blocks. Where the blocks are softened off in the engraving by means of fine lines starting from a solid and toning down to nothing, the overlays should be similarly treated, and should be cut or scraped away on the slant to give a gradual increase or diminution of the impression.

CHAPTER LXXXV.

COLOUR PRINTING AT MACHINE.

THE machines suitable for the colour printer are those of the single-side single cylinder variety, which embrace the various makes of Wharfedales, including the Bremner, the "Art Wharfedales" now made at Otley and elsewhere, and the fine and expensive single-side machines that come to us from Germany and the United States or are made here in imitation of them. In this chapter we shall suppose we are dealing with a high-class machine of the Wharfedale type.

For colour printing, as indeed for all other sorts of printing except small job work, the platen machine may be considered as obsolete. There is, however, a type of machine which has unique value for the colour printer, and that is the bi-colour machine. The chief value of two-colour machines is shown when it is required to print two formes registering into each other; but they can rarely be used with success where the second colour falls upon the first. Thus, a machine of this character would be admirably suited to print such things as Huntley & Palmer's biscuit tin wrappers, which are worked from blocks that do not overlap each other in any part; or it might be used with advantage for printing the black text of a work with ruled border and initial capital letters in red ink. But in doing this latter description of work on two-colour machines it is necessary—inasmuch as the paper

has to be printed on both sides—to use a quick-drying ink in each case, in order to prevent, as much as possible, the ink setting off on the cylinder when the second side comes to be printed.

So far as accuracy of register goes, these machines have been brought to a high degree of efficiency, but British engineers would be the first to admit that the acme in printing machinery has not yet been reached, and indeed they are frequently improving their patterns. Occasionally, excellent notions are conceived and carried out by the Continental makers. Thus, in some machines with which we are acquainted, the mechanism by which the table is drawn backwards and forwards is different in principle from that adopted by any of our English makers. In the Wharfedale and kindred machines the table is drawn in and out by means of a wheel, geared perpendicularly to a rack at the bottom of the table. There is consequently a momentary stoppage on the return at every impression taken. This may not, in itself, be a very grave objection, but when the racks and wheel become somewhat worn, the consequent backlash creates a shakiness which militates against the attainment of perfect register. In the machines we refer to this method of working the table is superseded by very beautiful motions, one of which consists of a large circular rack placed horizontally at one end of the machine. The teeth of this rack are placed inside, and a small-toothed wheel, to which the table of the machine is attached, revolves round the inside of the circular rack, carrying the table backwards and forwards with the greatest possible smoothness. There is no stoppage in the return, as the motion is continuous in one direction.

The points in colour printing at machine to which we shall have to direct our attention are as follows, and these, for the sake of lucid exposition, it will, perhaps, be as well to divide into sections:—

First, the mechanical arrangement of the machine, including the setting of the ductor;

Second, the dressing of the cylinder;

Third, the management and choice of rollers, so as to ensure a proper inking for every variety of work;

Fourth, the various methods of making ready, so as to exhibit the actual practice, up to date, of the best houses; and

Fifth, the management of machine inks.

Mechanical Arrangement of the Machine.—This is a question more for the engineer than for the machine minder. The working parts of the best Wharfedales have become so simplified that there is very little for the machine minder to arrange. It is, however, his function to see that his ductor-knife is properly fitted, because in colour printing, especially when the numbers are long, the ductor-knife needs to be taken out and thoroughly cleaned with every change of colour. It will naturally be his duty to see that his vibrator and his pointing apparatus perform their functions properly.

It is, of course, well understood here that every part of the machine should be in good working order, and special mention is made of the last two items on account of the important parts each of them has to play, one controlling the supply of the ink, and the other governing the accuracy of the register.

In some machines the vibrator is attached by an arm to an iron roller by means of a set screw. These set screws occasionally work loose, and the vibrator touches the ductor only at one end. The serious consequences that would accrue in a few minutes with a machine travelling at a thousand an hour can easily be conceived. Hence it is of the utmost importance that the vibrator should be so firmly fixed that this sort of accident is practically impossible.

The Setting of the Ductor.—When the knife has been taken out and properly cleaned for the commencement of

another colour, the ductor screws should be thoroughly washed with turps, because some coloured inks are from their nature so drying that neglect in this particular will soon make them unworkable. Supposing the knife and screws to be perfectly clean, all the machine minder has to do is to place the ductor knife perfectly flat in the frame or bed which is constructed to receive it, placing the edge of the knife in even contact with the ductor roller. Having done this, let him take the short set screws which push the knife into position and insert them in the holes made to receive them. They should be screwed up just tight enough to hold the knife in close contact with the ductor roller. Then the other screws with the shoulder on them, which serve the purpose of drawing the ductor knife back, may be put in. When this is done, the knife should be in even contact with the whole length of the roller.

Adjusting the Cylinder.—The next thing of importance which demands the machine manager's careful attention—and this is essentially a question for him—is the proper adjustment of his cylinder bearers and the arrangement of his roller lifts. The impression or cylinder bearers are usually sent in with the machine, and are consequently of the correct height, which should be a fraction above type high. The cylinder may then be lowered by means of the impression screws in the cylinder bearings until it fairly and evenly grips the bearers. This fact may be ascertained by placing a piece of pasted paper on the bearers, pasted side upwards, and pulling the machine round by means of the rigger. If the cylinder is sufficiently tight the piece of paper will be clinched by the cylinder and will adhere to it. There is another method of arriving at the same result when the bearers are made of wood, and that is by laying a pin on each of the bearers and pulling or striking the machine through once. If the cylinder is sufficiently tight on the bearers, the pins will

be indented and leave their shape upon them. Great care must, however, be exercised to see that the cylinder is not down too tight. It should just clinch the impression bearers and no more; but if too tight it causes a drag on the machine and a strain upon the motive power which drives it; while if it is not tight enough—and this is especially true of old machines—it is liable to slip and cause a slur.

Roller Lifts.—With regard to the roller lifts, or roller bearers as they are sometimes called, there is no particular difficulty in adjusting them. All the machine minder has to do is to get one of his inking rollers and place it in the forks which are designed to receive it. The small round pulleys at each end of the inker should run evenly upon the roller bearers. If they do not touch, or touch too lightly, the forme will not be properly inked—there will be a drag, and the forme will be smeared rather than evenly inked. In this case the bearers may be unscrewed and their height supplemented by pasting thick or thin cardboard underneath them until the necessary height is attained. If a forme of type or a forme of blocks exactly type high be placed upon the machine, the inking rollers should run evenly upon the bearers, and the rollers themselves should be in even contact with the forme.

Printing Four Colours at once.—Before leaving the question of the rollers and the ductor it is necessary to say a few words in connection with the management of the wavers or distributing rollers in certain specific circumstances. In very large formes of colour printing work it frequently happens that the last working is a grey, because that colour blends and softens the tone of all the previous workings; but it sometimes occurs, as for example in the eight-page sheet of the Christmas number of the *Graphic*, that there may be four distinct varieties of grey. It may be necessary to print two pages in a very warm grey, made possibly from burnt umber, a little lake, and the merest

touch of black. The next two pages may be required to be printed in a normal grey, made simply with a little black ink reduced with varnish to the necessary strength. The third two pages may require a grey of a greenish tone, made with, probably, raw or burnt sienna with a touch of Chinese blue or deep green lake. The fourth two pages may need a grey of a slatish or purple tone, made, probably, with Chinese blue, crimson lake, and a touch of black, the whole reduced with varnish until the necessary strength is arrived at.

The problem now is, How shall these four separate colours be kept distinct in the ductor without interfering with each other? The first thing to be done is to separate the colours in the ductor by means of the clumps cast in lead which are to be seen in operation on all cylinder machines. If these clumps fit accurately, there will be no difficulty in keeping the four tones of grey absolutely distinct. If it should be found that either of these colours is making its way beneath the lead clump, the ink must be taken out of the ductor and a piece of blotting paper placed underneath the clump which is causing the mischief. If this fails, it shows the clump has been badly cast, and it must therefore be discarded and replaced with another. We should now have, as it were, four small and entirely separate ductors. The next step is to cut the vibrator, and so arrange the waving rollers as to enable the machine printer to obtain a distinct and perfect inking in each of the four greys.

The vibrator would, in the first place, be simply cut in the gutters, leaving each individual section to be manipulated afterwards, according to the requirements of the forme; but this will be dealt with more copiously when treating of the making ready. With respect to the waving or distributing rollers, which ordinarily have a diagonal motion —hence the name of wavers—this diagonal motion must

be stopped. The distributing roller forks should be slotted, or fresh holes drilled in the frame, so as to permit of the wavers working horizontally, with scarcely any lateral play. Then they should be cut in the same manner as the vibrator. The last thing to call attention to in the mechanical arrangement of the machine is the setting of the grippers, which should be made to bite evenly all along the edge of the cylinder. The other matters will follow in due order.

The Dressing of the Cylinder.—It may be accepted as a principle which is confirmed by most colour printers that, speaking generally, sheets of paper on the cylinder are the best material with which block work may be printed.

In preparing the cylinder to print a composite forme of blocks and type—say, for the sake of example, double crown in size—the cylinder is sometimes prepared in the following manner. The machine minder obtains a sheet of stout double royal paper, and, folding it about an inch from the edge, pastes it securely to the edge of his cylinder, leaving the other end loose. Underneath this sheet he will place six or eight sheets of double crown, loose, close up to the edge of the cylinder; then the double royal sheet is pasted in three places at the bottom and made to adhere to the cylinder. Hence we have one thick sheet of paper fixed to each end of the cylinder, and six loose sheets underneath.

Having thus arranged the dressing of the cylinder for the composite forme we have been discussing, we now, having thrown the cylinder out of gear, run the colour up. Of course it is assumed that the character of the forme is known to the machine minder, and that he has cut his vibrator consistently with its requirements. With this packing on the cylinder, he would carefully underlay the engravings in his forme, and then, after passing a sheet through, he would probably realise that it was time to paste up his overlays. Now, it must be supposed that the overlays, each consisting of three thicknesses of thin

paper, have already been made, and are ready to stick on the outside sheet of double royal; but, inasmuch as this outside sheet of double royal has become indented with the impression it has received during the process of underlaying, it becomes necessary, when the overlays are to be stuck up, to replace this sheet by another. Therefore, we remove the first sheet of double royal from the cylinder and replace it with a perfectly clean one of the same character, and attach it to the cylinder in exactly the same way as the first. Having done this, and having our overlays all cut and ready, we stop the cylinder, permit the forme to be rolled several times, and then, setting the cylinder in motion, we take an impression on the double royal sheet which we have just fixed on the cylinder.

We are now in this position: the forme has been carefully underlaid and is fairly level underneath. What remains of the making ready has to be finished on the cylinder. The overlays are already cut and ready, and an impression has been pulled upon the outside covering sheet which is on the cylinder. Now, the next thing to be done is to stick up the overlays. Before those overlays are very carefully adjusted to the impression on the outside sheet on the cylinder, the reason will be explained why the loose sheets were placed under the thick covering sheet; for, as the overlay represents a thickness of three sheets of paper, the sheets on the cylinder are placed there purposely loose, so that the equivalent of the thickness of the overlay may be withdrawn. Therefore when, after having pulled our cylinder, as has been already suggested, we stick the overlays up as accurately as possible upon the outside covering sheet—it will be borne in mind that this sheet is attached to the leaving part of the cylinder by means of three dabs of paste—these ends of the sheet are either torn or cut away, the latter preferably, thus leaving the outside covering sheet with its overlay of three thicknesses.

In order to restore the balance in the dressing of the cylinder, we withdraw four of the loose sheets from beneath the sheet upon which the overlays are pasted. The loose sheet with the overlays on may next be slightly pasted at the bottom, and then the cylinder must be covered with a damp sheet, not too thick, but capable of giving an idea of the exact nature of the impression. It will have been gathered that this last sheet has been stuck up moderately damp, and therefore we must wait until the sheet gets quite dry before we venture to pull another impression. When the sheet has become quite dry, the machine minder, while running his waste, will take an opportunity of getting his inking quite right. Having done this, and the sheets on his cylinder being perfectly dry, he may strike through the machine a sheet of thin making-ready paper. In this respect the experienced machine minder knows pretty well what will happen, for, having stuck up on his cylinder an overlay of three thicknesses of paper, it is only natural to assume that the type on either side will be borne off by the thickness of the overlay, and will have to be brought back more or less perfectly in the making ready on the sheet which has been pulled after the sheet has been stuck up. On each side of the cuts where the type becomes light, it must be brought up by very thin paper. The cuts themselves may also be dealt with, the hard parts taken away with the knife, and the weak solids forced by means of small patches of thin paper.

When all this making ready is finished, and the machine minder believes that he has done as much as possible to the forme, he will naturally place another damp sheet up; let it get quite dry, and then he should be ready to go on. But before doing this, good, wide-awake workmen like to verify their judgment. It will be remembered that the inking is quite accurate, and therefore the experienced machine minder, before putting the final covering of damp

paper over his cylinder, elects to give his forme a good rolling, and to strike a couple of sheets through one on top of the other, so as to give him a chance of verifying his making ready. If he finds any parts of the making ready still too weak or too hard, he corrects these on the cylinder at once, and then strikes another sheet through to satisfy himself that he has done everything necessary. Being convinced upon this point, he covers the cylinder with a final sheet of damp paper, lets it dry as hard as a bone, and is ready to print right off the reel.

This is an example of the packing of the cylinder where loose sheets are used; and in composite examples like the foregoing it is a very valuable method, and is in use—with other systems—in some of the largest printing offices in London.

Before leaving this subject, as it is assumed that the forme represents the key or first working of a colour set, it will be necessary before starting to fix a set of points at each end of the cross, so that when the sheet is folded the point holes come exactly in the middle of the fold. These points are generally soldered or screwed into an iron plate about the thickness of a thick lead. Some machine minders are reckless enough to trust the fixing of them to a little of Prout's elastic glue; this, however, is a dangerous expedient, and in the writer's opinion should never be adopted, although he is bound to admit he has never seen an accident occur from its use. The best and most certain plan to adopt is to have two holes drilled and tapped at each end of the point plates, with corresponding holes drilled in the crossbar of the chase. The holes in the point plates would of course be counter sunk, and although this is somewhat more costly than merely sticking on the points with elastic glue, there is no possibility of any accident arising, as the machine minder is absolutely sure of his ground.

There is another method of hard packing which dispenses with the withdrawal of the loose sheets, and that is to stick up a half-dozen sheets of very slightly, but evenly, damped paper. These sheets should be pasted at each end, and stuck up one after the other. In drying, the damp paper naturally contracts, so that when the whole of the sheets are quite dry the result is a covering on the cylinder almost as hard as the iron itself.

The writer has seen, in France, this system still further developed. Instead of merely damping each sheet and pasting it at each end, the French machine minders, when they want an exceptionally hard packing, paste each sheet all over, taking care to see that there are no lumps in the paste, and that it is put on very thinly and evenly. This sort of arrangement, however, is only used at night time, just prior to the cessation of work, so that when the minder comes in the morning he has got the equivalent of a six sheet cardboard on his cylinder.

This is the sort of packing which M. Motteroz, the author of a very thoughtful essay upon "making ready," recommends to be used when dealing with rule work, which is very liable to crease. Indeed, in some extreme cases, he says that he has even made use of a very thin sheet of zinc; but this is a costly expedient, and would be impracticable in most commercial printing offices.

After all, the principle underlying the various systems of hard packing is the same in every case; that is, to get the packing upon the cylinder as hard as possible. If one has a forme of brass rules to print, and there happens to be a calico on the cylinder, one may take a clean glazed board and fasten it to the pitch of the cylinder by means of elastic glue, fixing the leaving end of the glazed board to the calico by means of large pins. This covering will enable the rule borders to be printed without visible impression on the back, and without any tendency to crease,

M. Motteroz goes so far as to say that he has never known a packing of this character to fail with that description of work.

Before quitting the subject of the dressing of the cylinder one remark may be made in reference to the very large white letter block work which is now largely used in showy colours by ginger beer and kindred manufacturers. This kind of work is usually printed in inks of good body, so as to give the necessary depth and richness. The cylinder may be hard packed with paper alone, or it may be covered up with a thin blanket. In either case the result is disastrous if the layer-on happens to make a miss, for the making ready in the hard-packed case would probably go round the rollers, and give the machine minder endless trouble before he could get things right again; while with the blanket, it would probably have to be taken off and washed, and replaced with a clean one. To obviate these bad effects a parchment is frequently stretched over the cylinder, so that if the boy makes a miss the parchment can be instantly cleaned with turps, and no further damage is done.

The Choice and Management of Colour Rollers.—The machine printer who has all his life been used to the management of type or stereo formes printed in black ink, finds himself, when called upon to execute colour printing from blocks, confronted with new and strange conditions, which his previous training has not fitted him to cope with; and it will be our object here to afford him such assistance as may be useful when he has a forme of blocks to deal with. As few coloured inks work so well as the best blacks do, it will be an important consideration that the best distribution possible should be obtained, and here the machine printer should take care that his vibrator and distributing rollers are in good condition. It may be laid down as a general principle, to which there are few

exceptions, that both wavers and inkers should be used less fresh for colour work than would be proper if black ink were to be used. The distributing rollers should, however, always be soft and fleshy, if not fresh. The same remark may be applied to the inkers, with this qualification, that when very heavy solid tablets are printed at machine, and the colours are required rich and full, the inkers should not be very new or soft, or they will not furnish ink to the forme so well as they would if tolerably well matured. On the other hand, when varnish tints, or tints with but little body, are used, the inkers should be good, new fresh rollers. The modern patent roller is the best for tint work at machine. Tints cannot be worked at machine with any approach to evenness if the inkers are hard; but a solid block, printed in positive colours, may be so worked with the assistance of heavy riders.

Colour blocks, unlike pages of type, are very rarely cut of the same strength all over their surface. You may have, for instance, the first working of a picture book (say the yellow), where the bottom parts of the blocks are perfectly solid and the top parts tinted by the graver to produce a paler tone of yellow. In all cases of this description the machine printer should supplement the efforts of the engraver by careful and skilful management of his vibrator, which should be cut away wherever practicable, in order that the quantity of ink may be diminished opposite those parts of a block which have been lightened by the engraver.

In printing solid flat tints, which are intended for backgrounds, at machine, it is quite possible, by carefully cutting the vibrator, to produce an evenly graduated tone of colour, deep at the bottom and lightening towards the top. Of course, if only one set of the block be printed, the same effect may be obtained by means of shutting off the ink in the ductor; but if there be two blocks side by side, and the same effect is required in each, the

only way to attain it is to cut the vibrator and possibly also the inkers.

It not infrequently happens that the machine printer may have to print a forme of blocks which are multiples of each other. For instance, the first working of a set of blocks may consist of a forme of solid borders imposed one under the other. If a forme of this character should happen to be a deep one, the blocks on the leaving part of the sheet would receive a very imperfect rolling, because the first revolution of the inkers on the forme would deprive them of most of the ink. In order to meet difficulties of this character, the roller forks on some machines are slotted, so that in case of necessity a diagonal rolling may be obtained; and there can be no doubt that facilities of this description are a great convenience to the machine colour printer, and enable him to produce work which, without such appliances, would be very difficult of attainment. By means of this diagonal rolling the machine minder is enabled to obtain an approximation to the effect which the pressman gets by crossing his forme in various directions with his roller.

In choosing rollers for colour work at machine we may refer to what was said about rollers in the chapter relating to press work, and we may recapitulate the following broad directions, in carrying out which the inexperienced printer will not greatly err: For varnish tints, use new soft but not green inkers; for body colours, use the same sort of roller but rather more matured; for vermilion red, let all the rollers be dry and tolerably soft; if fresh rollers are used for any red of which vermilion is the basis, whether it be tint or body colour, the brilliancy of the ink will be impaired; for Chinese blue, fresh rollers may generally be used; in printing pale yellow varnish tints, the inkers must not be too fresh, or the tint will print with a greenish hue; for grey varnish tints, fresh rollers may sometimes be used,

The Management of Machine Inks.—This is one of the most important questions which command the attention of all machine printers. In dealing, for instance, with any of the workings of the large Christmas supplements which are printed by hundreds of thousands, the colour has to be prepared wholesale. The various proportions of the tint inks which go to build up the picture, when once ascertained, have to be rigidly adhered to, or a very undesirable variety would be in evidence when the picture was finished. In very large formes, such, for example, as any of the solid workings of the *Graphic* supplemental portrait of the Princess of Wales, which are printed at a speed of from 800 to 1000 per hour, the machine overseer would probably elect to mix his colour in thin varnish, and there is much to be said for the advisability of this course. It must be borne in mind that there are twelve or fourteen colours to go one on top of the other, and the consecutive printings have to follow with considerable rapidity. Therefore, if middle varnish were used, the speed of the machine would probably have to be diminished, and after a few printings were done the thicker varnish, not being so readily absorbed, and lying on the surface of the paper, might cause the work to stick together. Hence that is one of the chief reasons which cause us, here in England, to elect to use for large work and long numbers a thin varnish as the medium for tint inks at machine. In France they take a different view, and if they do not use a varnish quite so thick as an ordinary middle litho varnish, they use one considerably thicker than the thin varnish which is in general use in England. The French printer argues that the thin varnish is too readily absorbed into the fibre of the paper, and spreads into it like a drop of ink on a piece of blotting paper. This is no doubt, to a certain extent, quite true; but then it must be remembered that the French printer has very

rarely such long numbers to deal with as are common in England.

There is another advantage of using thin varnish as a medium for the tint inks in the large work we are discussing. With thin varnish and a fair interval between, the first six or seven workings may be printed without interleaving sheets; whereas, if middle varnish were used, the interleaves would have to be put in at about the fourth working. Therefore it may be taken for granted that in large work and many workings, done at a high rate of speed, the English system of thin varnish as a medium is the best. For fewer workings and shorter numbers middle varnish may frequently be used with advantage.

Printing a Picture.—Having stated the general principles which govern ordinary colour printing at machine, we now propose to take a few illustration formes, and follow the making ready through from beginning to end. Let us suppose, then, that we have a reprint to do of one of the most beautiful pictures ever reproduced, *viz.*, the reproduction of Sir John Everett Millais' painting of "Cherry Ripe." This work was printed in about twelve colours. The colour plates were etched on copper, and electrotypes were taken of them; while the key containing the drawing on the face was cut in wood. As copies of this picture are still to be had in the picture and other shops, the writer has had less diffidence in choosing it as an illustration; and, on its merits, it is one of the best examples of high-class colour printing at machine, taking into consideration the fact that the edition printed of it was one of the largest ever reached by a Christmas number.

The first working, then, is the yellow. This forms the basis of the background, and enters slightly into the girl's face and dress. As the author happened to be engaged in printing this work, he will confine himself to stating, as explicitly as possible, how the work was done. There

is, however, little difference in the methods of to-day and those of the days of "Cherry Ripe."

Here, then, we have the first working of a large supplement, and, in the light of previous instruction, we ought not to be in much doubt as to the correct method of dealing with it. The first thing to do is to cover the cylinder. As a matter of fact, this first working was printed with a blanket; now it would be worked with sheets, but this is only an instance of the evolution which has taken place in the processes of making ready in colour printing. Bearing these general facts in mind, we paste half a dozen slightly damped sheets upon the cylinder and let them dry. For the time being, the cylinder is sufficiently covered to enable the machine minder to make the initial move in the making ready. The next thing is to get the electrotypes and the mounting boards and lock them up on the machine. First of all, we require two large mounting boards made of carefully selected seasoned wood, and clamped at each end to prevent warping. These boards should be at least two inches, laterally, wider than the plates which are to be mounted on them—this is to give room on the boards for the fixing of the points.

All these facts having been carefully thought out, these large mounting boards are then locked up on the machine. Nor must this locking up be done in a perfunctory manner. Between the two boards there should be a piece of metal furniture or an iron casting. Then the two boards should be joined by an iron clamp, to prevent one getting away from the other. When the boards are firmly fixed and locked up on the machine we are ready to fix our electrotypes upon them. In doing this great care and some intelligence are required. We must not forget that in this, the first working, the make up (as compositors express it), or the even distribution of the margin (as machine minders term it), must be carefully seen to. In this regard

the problem is very simple. The man, no matter who he may be, who has to make up the forme for the first working, is given a sheet of the paper upon which the work is intended to be printed. He is told the margin required, the space which the points will occupy, and the size of the plate when the printing is finished and the work has to be sent out to the public. Having these facts before him, his work, trained as he is, or should be, is almost of a mechanical nature, and generally in a very short time we find the electrotypes made up accurately on the machine and only awaiting the initial processes of making ready when the plates which have been mounted come into the unfettered hands of the machine minder. This being so, the first thing the machine minder will have to do will be to underlay his plates.

In dealing with very large work like this, it should be altogether out of the question to underlay the wood or mounting boards, as that would make the blocks rise and spring on the machine, and create no end of trouble. Therefore the underlaying must be done entirely underneath the plates. If the mounting boards are found not to be of the proper height they should be discarded and others substituted for them. Well, then, we will assume that we have to underlay the plates; and as they are very large, it follows that they have to be fixed very securely to the mounting boards. In order that this may be effectually done a wide flange—nearly half an inch in width—is left on the edge of every electrotype; and at intervals of every two inches a counter-sunk screw-hole is made. These holes very often amount to quite fifty, but for the purpose of making ready the plate may be fixed by a dozen screws. We shall assume that the machine minder has adopted this latter course.

It is the function of the overseer to see that this first working is made up absolutely correct with regard to the

margin, and this matter having been settled, we may either roll the forme up with a press roller in yellow tint ink, or put some yellow ink in the ductor and pull the sheets for underlaying with its own ink. As this first working is a yellow, and all yellows require to be printed absolutely pure, it will be better in this case to ink up with its own rollers; for this gives us a chance of cleaning the inkers, wavers, and vibrator, should they have been recently used for any darker colour.

In this regard, we may perhaps devote a few lines of explanation to the manner of preparing the rollers for this sort of work. In the first place, the vibrator, or the roller which conveys the ink from the ductor to the distributing slab, has to be cut to suit the requirements of the forme. In the illustrative case we are dealing with this is a very simple matter; because, the plates being nearly solid all over, there is little else to do than to cut the vibrator to the full size of the plate.

To go into detail, the vibrator for the two large plates we are dealing with would be put upon the inking slab of the machine, the spindles at the ends coinciding with the sockets or bearings in which they work. Then, without shifting this position, the machine minder gently rolls his vibrator from the slab until it covers his forme. Having done this, he sees at once the places in which the vibrator needs cutting. The piece of roller composition on the vibrator between the two plates will have to be removed, because no ink is required where the margin is. The same remark applies to each end of the vibrator; for those pieces of the roller which extend beyond the edge of the plates will have to be cut away. In cutting the vibrator, or indeed any other roller at machine, the composition should never be cut right down to the spindle—as this would weaken the roller and soon cause it to break up—but it should be cut in a slanting direction, so that the

bottom part of the composition is always adhering to the spindles.

Before leaving this matter of the vibrator, there is one other consideration in relation thereto that must not be overlooked. We have already stated that the yellow is nearly, but not quite, solid all over. If it were solid all over, the roller as we have cut it would exactly suit the plates; but it will be remembered that the yellow enters slightly into the flesh tones of the face, and obviously less ink will be required there than in those denser parts of the picture which go to build up the background. Therefore, in those parts of the vibrator which come opposite the face, it will be necessary—in order to prevent the fine engraving in the face from becoming filled up with colour—to cut a piece of the roller composition away. This done, the vibrator may be considered all right, and may be put into its proper place on the machine.

We are now in a position to put the ink in the ductor, to run the colour up, and get a sheet out with its own inking.

When the machine minder thinks he has run up enough colour to cover his inkers, he strikes the machine off, and, having got some clean waste, passes these sheets through the machine, and a sheet of its own paper last. This impression should give the minder a general idea of how his forme stands. He will be able to see at once if his inking is fairly level and even all over, and to judge if the cylinder requires raising or lowering at either side. If these contingencies arise—and very likely they will—he will correct the former by altering his ductor so as to regulate the supply of ink, and the latter by raising or lowering the cylinder as the case demands. This being done, more clean waste and one good sheet should be run through the machine, so that the minder may be sure that his inking and impression are quite right. Being satisfied on this point, he is in a position to begin his underlaying.

In commencing this operation, he will make use of the last white sheet passed through the machine. There is little difference in underlaying plates at machine and at the hand press; only, in dealing with very large plates on cylinder machines, care should be taken that the underlaying is not lumpy, because this has a tendency to make the plates crack. When this first sheet has been dealt with, the plates are unscrewed and the underlays pasted to the electrotypes, which are then screwed down again. More waste sheets should then be run through the machine, together with another white sheet, which should be treated in the same way as the first. This second sheet is generally sufficient to complete the underlaying; and if this turns out to be so, the remainder of the screws may be put in and the plates securely fixed for working.

Before proceeding any further with the making ready, the minder will do well to satisfy himself that his lay, which gives the proper margin top and bottom, is quite correct. About a half-inch gripper hold is what is usually allowed, and if there is too much margin at the gripper edge, the necessary reglet or lead must be taken out of the entry, and the plates shifted towards the edge of the cylinder. If, on the other hand, there is too little, the necessary furniture must be put in.

The lay and margin being now definitely settled, and the plates carefully underlaid, there is little more to do to complete the making ready. It will be remembered that we have covered the cylinder with six sheets of paper, which paper has now served its purpose by enabling the machine minder to underlay his forme with a very hard impression. Therefore, two of these sheets may now be removed, and the blanket, with which we intended originally to print the job, may be stretched around the cylinder. The blanket for use in work of this character, where the number to be printed is large, should be perfectly new, of

the best quality of finest Saxony wool, and the thinnest that is made; and when this is fixed over the cylinder, the making ready, so far as the impression is concerned, should be done.

It will be noted that no overlay has been cut and stuck upon the cylinder—the plates being underlaid with a hard packing impression, it is assumed that the thin, soft blanket will correct any minute defects in the impression. The only thing which might necessitate the lifting of the blanket would be a dip around the edges of the plates. If this happens, a sheet of thick paper should be printed and the impression of each plate cut round sharp, *i.e.*, cutting off about a thick lead of the work all round. These sheets may now be pasted on the cylinder. They should be covered with another sheet, not too thick, or in tightening up the blanket by means of the ratchet the overlay is liable to get shifted. The remaining function to perform is to fix the points (which are intended to register the key to the yellow) upon the mounting board.

It has already been mentioned that the boards have been purposely left large so that the machine minder may cut away enough of them on each side to enable him to fix the single point on each side of the sheet for the registration of the key. For this purpose he will require one spur in an iron or copper plate about the thickness of a thick lead. Screw-holes would, of course, be drilled in the ends of these point plates, so that they may be conveniently fixed by means of two screws to those places in the mounting boards which have been cut to receive them.

When the points have been securely fixed, the next necessary thing to do is to see that the roller lifts are in good condition. If they happen to be very much worn, the inkers will not run evenly upon them, and there will be a drag which will result in a defective inking. If this sort of thing happens they may be taken off the machine

and planed upon the surface, which of course makes them lower than they should be. In that case a length of non-pareil reglet or cardboard may be placed underneath to bring them to their right height.

So far as the making ready is concerned, this first working yellow forme may be considered ready. We have, however, to make the yellow ink in its proper proportions; get the tone of colour passed by the artist responsible for the general effect of the picture, and then make the bulk of the colour from which the whole edition is to be printed. Without going into preliminary detail of the trials and experiments which have been made at the artist's suggestions, we shall assume that we have arrived at that stage at which he is satisfied as to the tone and strength of the ink to be used for the yellow working, and that, inasmuch as the yellow tone inclines to the warm side, it will not be necessary to use lemon or pale yellow chrome; for this (although it might suit every other part of the picture except the face) would make the flesh tones on the face too green. Therefore, we elect to take a couple of pounds of No. 2 chrome —or golden chrome as it is sometimes called, because it is intermediate between the primrose or lemon on one side, and the deep orange on the other—and reduce these two pounds of ink with four pounds of thin varnish. This should give the colour, both as to texture and tone, which we require.

It will be borne in mind that the making ready has been done with its own inking, but for that purpose the machine minder would probably content himself with the rolling which four patent rollers would give him on one end of the machine. Now, however, that we are ready to start, he will have to make up his mind as to how many rollers he will use, so as to work the plates with the maximum of rolling and the minimum of ink. On an ordinary Wharfedale, large plates of this description would be double

rolled. This, of course, reduces the number produced by one half; *i.e.*, if the machine with a single roll gave ten reams per day, by double rolling we should only get five. Hence the great advantage, for this sort of work, of the powerful machines with extra inking appliances which are now available.

In the illustrative form we have been dealing with, it is supposed that this yellow working has been made ready upon one of Parsons' *Graphic* machines. The difference between the Parsons' machine and the ordinary Wharfedale is that in the former there are a ductor, slab, and rolling apparatus at each end. The advantage of this arrangement is that double rolling is attained without any loss of speed.

This being the case, the machine minder elects to work the job with eight inkers. Of these, he places five on the left side of his cylinder, which would answer to the outer forme of a perfecting machine, and three on the right side, which would answer to the inner forme. His inking being perfectly level, he is now, with one exception, ready to start; but this is important, and as it applies to all formes of this character, it will not be necessary to repeat the argument.

In dealing with very large plates, such as we have been here discussing, it has been found in practice that the momentum of the machine causes these large electrotypes to drive, so that even the fifty screws which are supposed to secure them to the mounting board, have been found too weak to prevent a slight and almost infinitesimal shifting of the plates from the pitch or entry of the machine towards the leaving part. Therefore the trained machine minder, being cognisant of these facts, does what experience has taught him to be the only method of controlling or preventing this drive. So that, before he starts, he puts in about thirty screws all along that edge of the flange of his plate in the direction in which the plates would be

driven by the momentum of the table; *i.e.*, on the leaving end of the machine, and not on the entry.

Everything, so far as the writer can remember, has now been considered in relation to this first working yellow forme.

The general statements regarding the making ready are applicable to all the subsequent colours. Therefore, we now take leave of this first working, which should be going smoothly on, and devote attention to colour number two. This, although made ready generally upon the same principles and the same system as the foregoing, is complicated with the principles of register; and, inasmuch as it is the key plate, and cut upon wood, it will have to be treated like any other large wood engraving, by means of a very carefully cut overlay.

Inasmuch as the edition numbers half-a-million, this key plate will, presumably, have to be printed upon another machine. Therefore, while the yellow first working is running on, preparation is, or should be, made to get the key plates ready. We shall suppose the same class of machine is to be used in doing this as in printing the yellow forme; the same system of underlaying will be adopted; and, in a word, the whole system is the same, except that we now have to make the register. In explaining how this is done, we shall, to prevent ambiguity, be very precise. Therefore, upon this second machine, where the key has to be printed, two large mounting boards, exactly the same as have been already used for the first working, must be prepared. The method of locking them up and properly securing them is just the same. It will be borne in mind that the yellow working is fixed and tied down by clamps. When the register is made, this same method must be adopted, as no shifting can be permitted, for the printing of the key plate is the most important working in the whole picture, and the one upon which the excellence of the rest depends.

We must first roughly underlay the plates and then proceed to make the register. In order to do this (the rough underlaying), we will have a gauge cut from the pitch or entry, which will enable us to place our plates upon the board in an approximately accurate position. These plates we will then fix to the mounting boards by means of four strong screws. This fixing will enable us, with care, to run the colour up, so that the forme may have its own inking, and that we may complete our underlaying under fair conditions.

The underlaying being completed, the register of the key to the yellow has now to be made. The first process, or rather the first function to perform, is to get a sheet of the yellow working and cut out at each of the four corners of each plate—we know, of course, that the subjects are duplicated, and are being printed "two set" —a portion of the work which coincides with the key. Having done this, and carefully put this sheet of the first working aside for further use, we unscrew the two plates which have been fixed temporarily to the mounting boards and take them off the machine. The next step in this complicated arrangement of making register is to arrange in our mind the amount of gripper hold we would like to have, which is, as has already been stated, about half-an-inch. Therefore we lay our sheet—the sheet of the yellow cut-out first working—with a half-inch gripper bite up to the marks on the machine.

Having now got our gripper margin arranged, we are prepared to strike the sheet through the machine, but we know that although the mounting boards are there, no plates are on the machine. The object of cutting the bits out of the corners was to enable us to place these two key plates in such a position that the register may be said to be practically completed. This, then, is the way it is done; We take a couple of those thin

small nails which are used in the mounting room, but which are sufficiently high to perforate any sheet which might be passed through the machine, and fix them on each side of the two mounting boards on the machine. This done, we strike through the machine the sheet we have on the laying-on board, and the two nails which have been driven in for the purpose perforate the sheet as they were intended to do. We now take the cut-at-the-corner impression of the yellow first working we struck through the machine, and place it, by means of the holes made in it, upon the nails which produced them. Having done this, we get our already underlaid key plates and place them upon the mounting boards underneath the sheet still there. The spaces which have been cut out indicate to us almost exactly the position they should occupy on the boards. Thus, the key plates, being approximately in register, may be fixed by a dozen screws, and the rest of the making ready completed in the ordinary way. It must be here noted that when the registration of the key to the yellow is finished, the two key plates should be clamped together, as was the case in the yellow first working; and this key forme should never, under any circumstances, be altered, because all the other colours follow the key. It is of importance, in reference to the key, that twelve points on each side of the sheet must be fitted to the forme for the registration of the printings which follow it.

Nothing need be said about the subsequent workings, because in their case we do but repeat the processes already described. We must make ready properly, take care that our plates do not shift, and secure absolute register. Of course, in no case must we begin any working till the prior working has quite dried.

CHAPTER LXXXVI.

Colour Printing (*continued*).—Harmonies and Contrasts of Colours—Matching Colours—Proper Combinations—Lists of Colours and their Constituent Pigments.

We have now to consider the laws which govern the harmonies and contrasts of colours in their application to the colour printer's art.

The proportions in which the primary colours should be used in contrasting and harmonising with each other are approximately as three of yellow, five of red, and eight of blue; and in order to bring this fact, in its practical application, home to the mind of the colour printer, we shall give a few examples.

Let us suppose that we have a bill to print in red, yellow, and blue, and that the forme consists of sixteen lines of type of the same size and set all to the same measure. Carrying out the principles we have just stated, in order to produce a harmonious result, three lines only should be printed in yellow, five in red, and eight in blue. Assuming that the pigments are absolutely pure, this arrangement of colour should give a perfectly harmonious result, and if this were the case the art of harmonious arrangement of colour in printing might easily be reduced to a science of mathematical precision; but it is unfortunately a fact that the pigments used by the printer are but representatives of colours which very imperfectly resemble the primaries in their absolute purity. There is no yellow pigment, for instance, of which it can be safely said that there is no

admixture of red or blue ; no red that is untainted by yellow or blue, nor any blue so pure as to be without any admixture of red or yellow. Nevertheless the proportions given above are sufficiently near for all practical purposes. In making a combination of colours in a forme like this the printer can only take care to have his pigments as pure as they can be obtained. Thus, with respect to the yellow which he should use, it should be the medium tone of yellow chrome ; the red should be magenta-crimson, and the blue one of the lighter shades of cyan blue. This gives us as near an approximation to the true primaries as can be obtained in printing. We will suppose that the type in which the forme has been set is all ten-line letter, but any single line in either of the colours might be changed to two lines of five-line letter of the same face without impairing the harmonious balance of the whole bill. Thus, one of the yellow lines, two of the red lines, and three or any other number of the blue lines may be changed into double the number of lines of five-line letter, while the harmonious balance would still be retained.

This theory holds good so long as the pigments are sufficiently pure to approximately represent the true primary colours. The moment one of these is modified the harmonious balance is lost, and must be restored by compensating modifications in the other two colours. Thus, if the yellow be made of a more orange tone, it is equivalent to adding so much more red to the area of the bill, and therefore the number of red lines would have to be diminished, or the tone of the red itself made more crimson by the addition of blue, so as to restore the balance. Again, assuming that the red and yellow remain unaltered, but the blue has been changed for one of a more purple hue, this would be the same as increasing the number of red lines, and the balance must be restored by increasing the number of yellow lines or reducing the

number of red ones, because the blue could not acquire a purple tone without the addition of red. If the blue and yellow colours remain in their integrity, but the red is altered to a rich crimson, it is the same thing as increasing the proportion of blue, which must consequently be diminished in area or intensity to restore the balance.

A pure blue ink, inclining neither to green on the one hand nor to purple on the other, which in the chromatic scale is computed at eight, finds its equivalent in the secondary orange, which is comprised of three of yellow and five of red, equalling eight, the power of the blue. Pure orange is therefore the proper contrasting or compensating colour to be used with blue. In contrast these colours mutually heighten each other, as they are each the complement of the other. Thus, if we were to print our hypothetical bill in two colours only, of which blue was one, eight lines should be printed in blue and eight in orange, to produce perfect harmony. And here we wish to say a few words in anticipation and explanation of an objection which will readily occur to the minds of all practical men. It may be said, and with truth, that a bright red in contrast with the blue would give in practice a more effective and a more brilliant result than does the combination of orange with blue, and that therefore the law which prescribes orange as the proper contrasting colour for blue is fallacious. But this would be an egregious error; the reason must be sought in another direction, and this will be found in the quality of the pigments which the printer is, in the present state of chemical science, obliged to use. All orange printing inks are made from chromes, which are by their nature opaque and dull colours; we cannot as yet make an orange ink which equals in intensity and lustre the finest ultramarine blues. If it were possible to get an orange pigment which possessed relatively the brilliancy and force of carmine, we should

obtain complete harmony with the greatest effect. The combination of orange and blue in printing is weak, not because the accepted law of proportions in colours is inaccurate, but because the colour-maker cannot give us an orange at all comparable in brightness and force to our best blues.

Taking the secondary green, which is composed of blue, the power of which is eight, and yellow, the power of which is three, making eleven, it is equivalent in contrast to red, the power of which is five; therefore there should be eleven lines of green, contrasted with five lines of red, to produce a perfectly harmonious contrast. Purple, which is composed of blue as eight and red as five, is equivalent in contrast to thirteen, in which proportion it should be contrasted with yellow. The tertiary colour russet, made of purple and orange, which may be described for the purposes of the printer as a red-brown, harmonises with the secondary green in the proportion of twenty-one russet to eleven green. The tertiary colour olive, made of purple and green, harmonises with the secondary orange in the proportion of twenty-four olive to eight orange. The tertiary colour citrine, composed of orange and green, harmonises with the remaining secondary in the proportion of nineteen citrine to thirteen purple.

Hitherto we have confined ourselves to a statement of the proportion in which the primary, secondary, and tertiary colours may be contrasted, illustrating the principles laid down with the simplest example which offered itself to the writer's mind—that of a bill containing a definite number of lines. But it must be evident to the practical printer that when he is dealing with blocks in two workings instead of type, the area of the respective blocks will very rarely conform to the proportions given and illustrated in the type forme. For example, we find that if we have to print a bill in red and green we require double the number

of green lines to those of red; therefore, in a pair of blocks which are required to be printed in these contrasting colours, the block which contains the larger amount of work should be chosen for the green. But it frequently happens in practice that the area of the blocks may be about equal in their printing surface, in which case a scarlet red made of vermilion, as representing the primary, would exceed the proportion in which it could be harmoniously contrasted with the secondary green; so that in order to make these two colours harmonise, the yellow and the blue elements, which are wanting on account of the diminished area of the green block, must be compensated for by such modifications in the two colours as will restore the balance. Thus, the red must be made of a more crimson tone, which is equivalent to adding a certain proportion of blue; while the green must be modified by the addition of yellow. The practical deduction to be drawn from the above is that where green and red are contrasted in printing, and the printing area of each forme is about equal, a red inclining to crimson and a green inclining to yellow should be used; and for the same reasons a green of a bluish tone must be contrasted with a red which inclines more to orange than to crimson.

The Law of Simultaneous Contrast.—This may be stated as the effect which one colour has in modifying another, when the two are in juxtaposition. This modifying effect is caused by the complementary of one colour acting upon the colour with which it is contrasted. Let us, for the sake of example, take the primary colours, red, blue, and yellow. The complementary of yellow is purple; the complementary of red is green; the complementary of blue is orange. When red is in immediate contrast with any other colour, it imparts to that other colour a greenish tone; when green, it imparts a reddish hue; when yellow, a purple tone; when purple, a yellow

tone; when blue, an orange tone; and when orange is contrasted with another colour, it imparts to that colour a bluish tone. In colour printing the effect of this law of contrast, though doubtless theoretically true, is not always marked with the same degree of strength. In some few cases its effect is scarcely perceptible, while in others its operation is distinguished by an unmistakable force which clearly demonstrates its power, and has doubtless been the means of suggesting many perplexing problems to those engaged in matching colours who are ignorant of its working.

In Chevreul's work, in the original French, these facts and principles are copiously illustrated by appropriate coloured plates, but any printer may effectively test them by a very simple and cheap method. If we take a piece of boxwood, say, about two inches square, which will of course print a flat, solid tint, and then have another block cut which will simply be a line or border two picas wide, fitting close up to the solid block, we have an effective means of testing and illustrating this law of contrast. We will assume that we have imposed the solid block in a small chase, with a pair of small first working points for the registration of the border. We now make a tint of normal grey, which may be made either as an opaque colour with flake white tinged with a little black, or as a transparent tint made with strong varnish and a small proportion of black. Either of these will answer the purpose, but care should be taken that the grey is of a very pale tone, and the black used should be a pure black, without any admixture of blue, which is largely used by printing-ink makers in the composition of their inks. For this reason, perhaps, it would be better for the purposes of this experiment to procure a small quantity of dry Paris black and use that in the making of the grey. We may now pull about twenty impressions of

this grey tint from our solid block, taking care in printing them that they are all about the same strength of colour, and put them by for further treatment, when we come to print the border. We now wash up and make half a dozen different tints of about the same relative strength as the grey. These should be made as follows: Pale pink (flake white and a touch of carmine), pale green (flake white and a touch of middle green lake), pale blue (flake white and a touch of Chinese blue), pale purple (flake white and a little purple lake), pale buff (flake white and a little orange), and pale primrose (lemon chrome and white). The same number of impressions should be pulled in each of these tints as in the grey. The first working may now be lifted, and the border registered to it. When this is done, the positive colours in which it is proposed to print the border should be got up; and if convenient the readiest way would be to have small rollers and as many slabs with the following colours: Deep purple, bright green, carmine, deep orange, ultramarine, deep yellow, and black. These will enable us to demonstrate not only the effect of the law of simultaneous contrast, but also another principle in chromatics—namely, that which tells us that when a dark colour is contrasted with a paler tone of the same colour the effect of the contrast is that the dark colour appears darker and the pale colour paler. Thus, if we take an impression of the pale grey we have already pulled, and print the border in black, the effect is to make the grey appear paler. The effect of the contrast on the black, although we know that it exists, is not evident to the eye; but in the other cases—for instance, where deep green is contrasted with pale green, and carmine with pink—the increased force is distinctly apparent, and this is one reason why it is correct, in printing and in the decorative arts, to place a deeper tone upon a pale tone of the same colour. It is therefore always right to print

carmine upon pink, deep blue on pale blue, deep green on pale green, deep brown on buff, deep purple on pale purple, and so forth.

Reverting to the positive colours and the border forme with which we were about to deal, we pull an impression of the border in each of these positive colours on the grey first working. Now, if we compare the grey as modified by the addition of the border pulled in these several colours, we shall find that it differs in tone, not only from the impressions that are without the border, but that each of the greys with the border differs from the others. If we examine the grey of which the border has been printed in a bright yellow, we shall find that it has taken a distinctly purple tone, and looks a totally different colour from the impression without the border. If we examine the grey which is surrounded by the carmine border, it will be seen that it has acquired a distinctly green tone; the grey which is surrounded by the blue border will be modified by its complementary orange, and it will be therefore of a warmer tone than it appears without the border; but as a matter of fact the writer has found that in practice the complementary of blue (orange) has but little appreciable effect in modifying a tint of normal grey. The same remark may be applied to the purple, the complementary of which (yellow), like the blue, has a less powerful effect than those of the red, yellow, and green.

We next examine the grey which has been surrounded by the bright green border, and here the effect of the complementary of the green (red) is forcibly evident. The cold grey has taken a distinctly warm tone—so much so, in fact, as to appear as though pink had been used in its composition.

Having shown the effect of these strong positive colours when in contrast with a neutral grey, we now propose

to carry the illustration further, so as to exhibit the result when in contrast with those pale tones of colours with which we have already provided ourselves. In the first place, if we take an impression of each of the pale tints that have been pulled, and print the border in a deeper tone of the same colour—*i.e.*, green round green, purple round purple, blue round blue, carmine round pink, deep yellow round primrose—we shall get a further illustration of the contrast of tone; the pale tints which are enclosed in the border will appear still paler, while the colours in which the borders themselves are printed will appear deeper and brighter than impressions of the border alone printed in the same colours.

If we now take one of the pale green and print the border in carmine, the effect of the contrast will be to make the green lighter in tone, but more vivid in hue. We have here a contrast of tone as well as a contrast of colour, for the carmine is relatively darker than the green, and will therefore throw it back and make it paler; while the complementary of the carmine, which is green, will intensify the brightness of the paler tone. This fact will be distinctly evident if the reader compares an impression of the green without the carmine border. If we print the carmine round the pale blue we simply obtain a contrast of tone, the effect of the complementary being insufficient to change the hue of the blue. If, however, the carmine is printed round the primrose yellow, the effect is of a very positive character, and the yellow acquires a distinctly green tone. When the carmine is printed round the pale purple a contrast of tone is the only appreciable result, the power of the complementary being insufficient in this instance to sensibly modify the tone.

Leaving the carmine, we will take a few of the more striking examples from the other colours; for, these ex-

amples being intended to illustrate principles, we shall content ourselves by giving so many of them as seem to adequately answer that purpose, as it is unnecessary, and would take up too much space, to go through the whole list *seriatim*. Let us, then, take an impression of the pale purple without the border; an impression of the same with the border printed in deep purple; and another impression of the pale purple around which we print the bright green border; also another impression around which we print the border in bright yellow. We have now this pale tone of purple in four conditions. In the first place we have it pulled by itself, free from any contrasting or modifying influence, and therefore in its normal strength of tone. In the second place it is surrounded by the deep purple border; there is therefore no contrast of colour, but only a contrast of tone, which has made it sensibly paler than the impression without the border. In the third place, where the purple is surrounded by the bright green, the effect of the contrast is powerfully evident in the changed tone of the purple tint, which has been so greatly modified by the effect of the complementary of the green that it actually looks almost a pink. In the fourth instance, where the pale purple is contrasted with the deep yellow border, the effect of the contrast is to heighten the brightness of the purple tint, because yellow being the complementary of purple it simply adds to its vividness without changing its hue. There is also another very remarkable effect of the power of the complementary in the case where pale pink is contrasted with deep yellow, the complementary of the yellow making the pink appear thoroughly purple in tone.

It will be noted that in illustrating this law of contrast we have chosen pale tints upon which to exhibit the effect of the complementaries of the positive colours, and in this we have followed the example of Chevreul, who does

the same thing without stating the reason why. It is a fact, however, that the pale tones of colours are more sensitive to the operation of the law of contrast than are the positive colours.

It must be evident to all reflecting minds that an intimate knowledge of this law of contrast and its effects should form a portion of the education of every intelligent colour printer. By the aid of this knowledge, many things which were obscure and mysterious become clear and intelligible. For instance, one of the examples given above actually occurred in the writer's own practice. Two impressions of a flat tint, representing the first working of a conventional ornament, cut up by an outline block which formed the second working, had been pulled in pale purple. In one case the outline had been printed in deep purple and in the other in deep green. This converted the purple into a pink, and when the work itself came to be printed a pink ink was actually used in matching the colour, with the most unfortunate consequences. It was that particular incident which first suggested to the writer the great importance to the printer of a perfect acquaintance with the law of contrast.

It will be apparent from what has already been written that the broad principles which govern the harmonious arrangement of colours are comprised in the observance of two fundamental rules—namely, that when colours are used in contrast with each other, the proportion of each should be based upon the prescriptions of the known laws which have already been stated; and allowance should be made for the operation of the law of contrast in modifying them. As, however, many may have neither the time nor the inclination to thoroughly master this somewhat abstruse subject, we shall endeavour to give such hints as may, in very many instances, enable the reader to dispense with the labour of doing so.

Even in ordinary commercial work the printer is frequently called upon to print a wrapper or a card upon a tinted ground in one or two colours, and from the absence of special training or of a ready means of reference, is often in doubt as to what colour or colours would be appropriate. In dealing with tinted grounds upon which one colour only is to be printed, the rule is very simple, and the colour chosen may always be a deeper tone of the colour of the ground; but inasmuch as there is an infinite variety of shades in tinted papers and card, the particular tone of the paper we are dealing with should be matched as nearly as possible in the ink chosen to print thereon. The object to be aimed at should be to make the colour of the ink used for printing on a tinted ground so blend with it as to offer no abrupt contrast to the eye.

For instance; there is a large variety of shades of green; if we had a delicate tint of sage-green paper to print upon, it would not be correct to use a green inclining to blue, because it would not blend or harmonise with the background. In this case the green ink used for printing should be toned to match the background (*i.e.*, the tinted paper) by the addition of a little burnt sienna. And, conversely, if the green-tinted paper to be used inclined to blue, the green used for printing on it should be of a similar tone. In dealing with yellow and buff-tinted papers it is always right to use rich browns, maroons, or chocolates, always bearing in mind the broad principle that the tone of brown chosen should be of a similar tone to that of the ground. In theory it would also be always correct to use the complementary of the ground as a contrasting colour, but in practice, from various modifying causes, the result is not so uniformly effective as to warrant the assertion that the complementary colours of the grounds may always be used.

In many instances, however, it is both correct in theory

and effective in practice to do so. The following instances will show where this principle may be adopted with advantage, and also where it is inadmissible. On yellow tints its complementary colour (purple) may generally be used. On pale buff tints, inclining to orange, ultramarine blue may also be used. Upon blue tints, orange, which is its complementary colour, is totally ineffective, and deep blue, carmine, or purple should be used instead. Upon pink tints, also, green, which is its complementary, is ineffective, and carmine or purple upon pink yields a much better result. Upon pale green grounds the complementary (red) may be effectively employed, as may also deep rich purple. Upon pale purple grounds its complementary (yellow) is useless; but deep purple, deep blue, or carmine gives excellent results. Upon grey papers, black is, of course, always correct, although the effect is cold and sombre. If it be desired to use a coloured ink in lieu thereof, carmine, purple, or ultramarine blue may be used with propriety.

In printing upon very deep-coloured grounds, such as deep browns, greens, and blues, it sometimes happens that the colour of the ground is too deep to make an effective contrast with a deeper tone of its own colour. Thus, we may have a very deep green to print upon; acting upon the principles which have just been stated, it would be correct to put a deeper green upon it; and if this were done, notwithstanding that the deepest possible ink were used, it might still be found that it did not make a sufficiently strong contrast to render it effective when printed. In these cases its own colour must be abandoned, and black used instead.

It may be laid down as a principle that the deeper the ground becomes the more difficult it is to produce effective results in colour alone. The very reason, however, which renders deep grounds unsuitable for strong

effects in colour fits them admirably for printing in gold; because in gold printing, the deeper the ground the greater is the contrast between that and the gold. Enough has now been said to remove any doubt as to which is the appropriate coloured ink to put upon any coloured ground when dealing with formes or blocks in one working.

Appended to this will be found tabulated arrangements of colour for blocks or formes in two or three workings; and these arrangements of colour may be taken as illustrating precisely the practice of the best artists. They may be applied with propriety to anything, whether it be a book wrapper, a menu card, or an ornamental design. It should be borne in mind that in combining colours in printing it is of the highest importance that a proper balance as regards strength should be attained. This is a matter which is frequently overlooked, even in such simple matters as a book wrapper in two workings. When two colours are chosen, they should be as nearly as possible of equal strength, to produce the best effect. For instance, it would not do to contrast a brilliant carmine red with a weak or washy blue or green; nor would it do to contrast a vivid and brilliant green with an impoverished or inferior red.

Contrasting colours should be, as a rule, of the same tone—thus, a rich, full carmine might be contrasted with a full and rich ultramarine; but if we use a pink instead of a carmine, the ultramarine must be toned with white, so as to make it equal in relative strength to the pink. When an impression of anything has been pulled in two workings, the effect upon the eye should be one of complete repose. If one colour strikes the eye obtrusively and with greater force than the other, we may be sure there is a want of harmony somewhere which needs correcting. Either the deeper colour is too deep and causes a too abrupt contrast, or the paler colour does not possess

sufficient force ; and according to which may be considered right, the strong colour would have to be subdued, or the weak one strengthened, until they possessed an equal force.

Matching Colours. — In concluding this treatise upon Colour Printing, we give a few hints of a practical character upon matching colours generally. The colour printer has frequently an impression of a subject in six, seven, or more workings given him to match. Supposing that the pale tones are printed first and the outline last, there is a constantly modifying process going on from the first printing. This is attributable to two causes—*viz.*, the operation of the law of contrast, which modifies the hue to a greater or less extent, and the operation of that law of chromatics which tells us that when pale colours are contrasted with dark ones, the dark become deeper and the pale paler. Therefore, if we match the first printings by simply contrasting them with the colour as seen in the finished impression, they will infallibly be wrong, because the colour will be seen as modified by the above-mentioned causes.

In matching colours, therefore, it is necessary to neutralise the effect of these disturbing influences, and this may be best done as follows: Assuming that we have to match a pale blue, green, pink, or purple, surrounded by other colours, the best and simplest plan is to get a piece of thick white paper and cut a hole therein, which shall only allow the colour to be matched to show through, and thus the influence of the other colours is avoided. In matching colours which have been made with flake white they should always be made a shade or two deeper, as they invariably become paler in drying.

Proper Combinations of Colours.—Appended will be found a list of combinations in two and three colours, which may be used on white and tinted grounds :—

Combinations of colour in two workings on white ground:—

Bright green[1] and vermilion red.
Bright green and carmine.
Bright green and purple.
Bright green and warm brown.
Blue green and orange.
Ultramarine and carmine.
Ultramarine and maroon.
Ultramarine and warm brown.
Light blue and bright orange.
Purple lake and bright yellow.
Crimson and bright yellow.

Combinations in two colours upon pale yellow grounds which incline more to lemon than to orange:—

Yellow green and carmine.
Yellow green and maroon.
Sage green and maroon.
Sage green and carmine.
Bright green and red brown.
Bronze colour and carmine.
Bronze colour and purple.

Combinations in two colours upon pale yellow grounds which incline more to orange than to lemon:—

Bright pale ultra and orange.
Bright blue green and orange.
Bright blue green and carmine.
Bright ultra and carmine.
Bright ultra and maroon.
Blue green and maroon.
Bright ultra and bronze colour.
Bright ultra and red brown.
Bright ultra and red purple.
Blue purple and orange.
Blue purple and carmine.

[1] By bright green is meant the middle shade of green lake; by blue green is meant the deepest green lake and white; by bronze colour is meant medium chrome and a little purple lake.

Combinations in two colours upon pale purple grounds:—

Red purple and ultra.
Red purple and blue green.
Blue purple and crimson.
Ultramarine and carmine.

Combinations in two colours upon pale green grounds of a bluish tone:—

Ultramarine and carmine.
Ultramarine and red purple.
Deep blue green and red purple.
Deep blue green and carmine.
Deep blue green and maroon.

Combinations in two colours upon pale blue grounds:—

Deep ultra and red purple.
Deep ultra and carmine.
Deep blue green and carmine.
Bright green and red purple.
Bright blue and red purple.

Combinations in two colours upon pale green grounds inclining to yellow:—

Bright green and carmine.
Bright green and purple.
Bright green and red brown.
Bright green and maroon.
Sage green and either of the above.

Combinations upon pale green grounds which have been toned with brown—*i.e.*, sage green:—

Deep sage green and carmine.
Deep sage green and red purple.
Deep sage green and maroon.

Combinations in two colours upon pale pink grounds:—

Carmine and bright ultramarine.
Carmine and bright green.

Carmine and blue purple.
Carmine and bronze colour.
Purple and bronze colour.
Light ultra and bronze colour.
Red purple and yellow green.

Combinations in two colours upon deep buff grounds:—

Maroon and deep blue green.
Maroon and deep ultra.
Deep purple brown and carmine.
Deep blue purple and carmine.

Combinations in two colours upon light brown grounds:—

Carmine and deep purple.
Carmine and deep green.
Carmine and black.
Maroon and deep green.
Red purple and deep green.
Deep brown and deep green.
Deep brown and black.

Combinations in two colours upon green grounds of medium strength:—

Deep green and deep purple.
Deep green and maroon.
Deep green and carmine.
Black and carmine.

It will be noted in the foregoing examples that the governing principle in most cases is that one of the contrasting colours is a deeper tone of the colour of the ground; if it is necessary to use gold instead of one of those contrasting colours, the reader will always be right if he retains the colour which is a deeper tone of the ground and substitutes gold for the other colour. Thus, in the combination upon a pale pink ground, carmine and ultra are given; the blue should be omitted and gold used instead—and so on throughout the whole series.

Combinations in three colours upon white grounds:—

Carmine, bright ultra and purple.
Carmine, bright green and purple.
Carmine, ultra and purple brown.
Blue purple, maroon and yellow green.
Purple, orange and blue green.

Combinations in three colours upon pale pink grounds:—

Carmine, ultramarine and bronze colour.
Carmine, blue purple and bronze colour.
Carmine, purple and blue green.
Red purple, bright blue green and bronze colour.
Bright Chinese blue, carmine and purple.

Combinations in three colours upon yellow grounds:—

Carmine, ultra and purple brown.
Carmine, yellow green and purple brown.
Carmine, yellow green and purple.
Deep brown, ultra and purple.

Note.—Where ultra is used upon yellow grounds the yellow should incline to orange.

Combinations in three colours upon blue grounds:—

Carmine, ultra and purple.
Carmine, blue green and purple.
Carmine, yellow green and blue purple.

Combinations in three colours upon pale purple grounds:—

Purple, ultramarine and bright green.
Carmine, ultramarine and bright green.

Note.—Combinations given for pale blue grounds also suit purple grounds.

Combinations in three colours upon pale green grounds:—

Ultramarine, bright green and carmine.
Ultramarine, bright green and purple.
Carmine, purple and yellow green.
Bright green, carmine and bronze colour.

List of Inks.—Below are inks of various hues with particulars of the ingredients used in making them. For most purposes one ounce of dry colour should be rubbed into as much varnish as it will take up and ground well with the muller; and, in general, it will be found that the proportion of colour to varnish comes out fairly consistently. In certain cases, however, there is a great discrepancy; for instance, if you take an ounce of flake in its dry state it would not yield, when mixed with middle varnish, much printing ink, because being made of lead it is about the heaviest pigment we have. The same remark in a modified form may be applied to vermilion, which is an extremely heavy colour; of this, it is quite possible to cram three ounces into one ounce of varnish. On the other hand, all the spirit blacks are extremely light and require a large proportion of varnish to dry colour.

Though strong varnish always gives the best results as regards colour, it is somewhat difficult to manage, and therefore for ordinary purposes middle varnish may preferably be used.

Small quantities of all the dry colours which are mentioned here (from an ounce or so) may be bought of Cornelissen's, in Gt. Queen Street, London. Winstone & Co., in Shoe Lane, also sell these dry colours in small quantities.

Blacks.

No. 1.—In making up the best qualities of black ink it should be borne in mind that Paris black and all spirit blacks are extremely light; for instance, a quarter of a pound of Paris black, which is sold in lumps about the size of a walnut, would fill one of the bags used by bakers for two pounds of flour; hence a small quantity by weight will be enough for our present purpose—probably only an experimental one—of making a little good black ink.

No. 1.—Take an ounce of No. 1 Paris black and rub into it as much middle varnish as it will take up; this should be then well ground with the muller and the ink is ready for use. In this case we depend upon the siccative qualities of the varnish for the drying, and upon the quality of the black for the depth and body of this ink.

No. 2.—Take rather over three-quarters of an ounce of No. 1 black and add to it nearly a quarter of an ounce of well-ground Chinese blue ink; this gives a rich blue-black ink which does not require any driers, the Chinese blue being a powerful drier by itself.

No. 3.—Half an ounce of Paris black ink (No. 1) mixed with half an ounce of blue violet lake ink (instructions for making which will be found further on); this makes a rich purple black; it may of course be modified by increasing or diminishing the relative proportions.

Browns.

No. 1.—One ounce of agate, mixed with as much varnish as it will take; this colour is rather hard, so that it must be well ground.

No. 2.—Three-quarters of an ounce of agate ink, with a quarter of an ounce of magenta lake ink.

No. 3.—Five parts of magenta lake and one part of Paris black; but the same quantity of any good black printing ink will do as well.

No. 4.—One ounce of refined burnt umber in powder; mix in as much middle varnish as will make a stiff ink, and grind well. This is a hard pigment, and if not well ground, it will not work clear.

No. 5.—Three parts burnt umber, and two parts crimson, scarlet, or magenta lake; mix and grind as before.

No. 6.—Umber, three parts; lake, two parts; purple lake, one part; mix and grind as before. The tone of this

colour may be modified by altering the proportions of its component parts ; if more umber and less red be used, it will make a yellower brown, while if the proportion of red be increased, the brown will be warmer in tone.

No. 7.—Vermilion mixed well with varnish, and sufficient black added (which will be a very small portion) to produce the tone required.

No. 8.—Made of burnt umber and vermilion red. Four parts of umber and two parts of vermilion ground in middle varnish will give this result. The colour may, of course, be made redder by increasing the quantity of vermilion, or yellower by increasing the proportion of umber.

No. 9.—Pure burnt sienna. One ounce of refined burnt sienna in powder ground in one ounce of middle varnish.

No. 10.—Sienna and lake. Three parts of burnt sienna ; two parts of scarlet lake.

No. 11.—Three and a half parts of medium chrome ; two parts of purple lake.

No. 12.—Brilliant lake and black. Four parts of brilliant lake ; one part black.

No. 13.—Indian red, ground as usual in middle varnish.

No. 14.—Indian red, lake and black. Four parts Indian red ; three parts lake ; one part black.

Reds.

No. 1.—Pure carmine. One ounce of pure carmine ground in middle varnish.

No. 2.—Magenta lake. One ounce ground in same quantity of varnish.

No. 3.—One ounce of brilliant lake (Cornelissen's) ; one ounce of thin varnish.

No. 4.—Maroon lake. May be bought in small quantities at Cornelissen's, under the name of rich crimson. Mix with thin varnish.

No. 5.—One ounce of geranium lake, ground in middle varnish.

No. 6.—Pure vermilion. Grind stiff in middle varnish.

No. 7.—Four parts vermilion ; two parts scarlet lake.

No. 8.—Three parts vermilion and two parts crimson lake.

No. 9.—Pink : carmine and white. Six parts flake white and one part carmine. Lake may be substituted for the carmine, with a proportionate diminution in the cost.

No. 10.—Madder lake. One ounce ground in middle varnish.

Purples.

No. 1.—Blue purple and white. Blue purple lake, one part ; flake white, three parts ; ground in middle varnish.

No. 2.—Carmine violet. This is a cochineal purple, and is very expensive. One ounce of carmine violet ground in middle varnish.

No. 3.—Blue purple and ultra. Three parts blue purple lake ; one part ultramarine blue.

No. 4.—Red purple and white. Five parts flake white ; one part red purple lake.

No. 5.—One ounce of mauve lake and one ounce middle varnish.

No. 6.—Purple and brilliant lake. Three parts purple lake ; one part brilliant lake.

Blues.

No. 1.—Cobalt. One ounce of cobalt blue ground in same quantity of varnish.

No. 2.—One ounce of Chinese blue ground in one ounce of middle varnish. It is a hard pigment, and requires well grinding.

No. 3.—Ultramarine and white. Five parts of flake white and one part of ultramarine. This colour, like all others

made with white, may be deepened by the addition of more of the colouring pigment.

No. 4.—Chinese blue, one part ; flake white, four parts ; grind well in middle varnish. If the colour does not work clearly, add a little curd soap in shreds, and grind well with it.

No. 5.—One ounce Steinhoff's or Erensperger's light ultramarine ; mix in middle varnish.

No. 6.—Deep ultramarine, of Steinhoff, ground in middle varnish.

No. 7.—Four parts ultramarine ; one part Chinese blue ; one ounce of middle varnish.

No. 8.—Antwerp blue. One ounce of Antwerp blue ground in same quantity of middle varnish.

No. 9.—Chinese blue and varnish. This consists of one part of the ink used for No. 2, reduced with two parts of middle varnish.

No. 10.—One ounce of deep green lake ground in same quantity of middle varnish.

No. 11.—Four parts of flake white, and one part of deep green lake ground in one ounce of middle varnish.

Greens.

No. 1.—One ounce of middle green lake ground in middle varnish.

No. 2.—One ounce of pale green lake ground in middle varnish.

No. 3.—One ounce of Corry's pale primrose chrome, toned to shade with a little Chinese blue.

No. 4.—Sea green. A very bright pigment, but not containing much body. One ounce in middle varnish.

No. 5.—Sage green. One ounce of ink used for No. 3, with the addition of a little burnt sienna.

No. 6.—Pale lemon chrome and varnish; usual proportions.

No. 7.—Medium chrome and varnish; usual proportions.

No. 8.—Orange chrome and varnish; usual proportions.

No. 9.—Bronze colour. One ounce of medium chrome, toned to shade with a little purple lake.

CHAPTER LXXXVII.

Three-colour or Tri-chromatic Printing.

As was stated in Chapter LXXVI., Three-colour or Tri-chromatic Printing is the result of adapting the theory of chromatics to the art of producing photographic blocks by the Meisenbach process. How this is done is sufficiently described in that chapter. The result is that we are able to obtain three blocks, each reproducing only those parts of the object photographed which reflect one or other of the three primary light colours, either in its simple state or in combination. If these blocks be produced accurately and be worked successively with absolute register in the primary pigment colours—primrose yellow, magenta—crimson, and cyan blue—the result should be a faithful picture in its own hues of the object photographed.

It is obvious from what has been said that the credit of successful three-colour work lies more with the producer of the blocks and with the ink-maker than with the printer. Given perfect blocks and perfect inks any printer who can use these properly and print with perfect register can achieve the best results. On the other hand, if the printer knows well how to print in colours from a half-tone block, and knows how to register accurately, and yet the work does not attain to excellence, the fault will lie either with the blocks or with the inks, or may be with both.

It is seldom that perfect blocks can be obtained, if indeed it be not, as purists would tell us, impossible. First, it is extremely difficult to get screens or filters which will allow only the desired rays to pass them; some traces of

the others are always present; and just as he is the best general who makes fewest mistakes, so he is the best photographer for three-colour work whose filters exclude most of the colours not wanted at the moment. Again, the blocks must not only reproduce the object each in its own primary colour, but they must all three register accurately with one another, and here again the variations in material, in atmosphere, in temperature, and in position, slight though they may be, have their effects, and these detrimental to the best results. Hence the three negatives should be taken and the three blocks produced as nearly simultaneously as possible, for otherwise those variations which were referred to on page 816 of Vol. I. as hindering the colour printer will tend to spoil the effect of this particular kind of printing.

Once more, although the blocks be as perfect as possible and the pressman's art of the highest, good results are out of the question unless the proper inks be used. It has been the care of the chemists attached to the best ink manufactories to choose pigments which shall with the greatest accuracy produce the primary pigment colours, but though they have done very much in this direction they will frankly acknowledge that they have not yet succeeded to the full. You cannot get a primary pigment which does not to some extent reflect the other primaries, and thus we have another source of error. All that can be done is to come as near to perfection as possible: absolute perfection is at present impossible, and probably ever will be so.

Yet, given the best blocks and the best inks, the skilled printer can with three workings produce results which are often little less than marvellous, and it is seldom now that a large number of workings need be resorted to, as used always to be the case in bygone times when the best work was required.

How the printer should make ready a half-tone block and treat it both at press and at machine has already been dealt with in Chapter LXVIII. (Vol. I., p. 762), and we need do no more than refer to this. As regards inks, he will do well to purchase them from firms who make them specially for the work, and not to attempt to manufacture them himself. We may, however, point out that not only must the colour be correct and full-bodied, but the pigments which produce such colour must be of such a transparent nature that the effect of former workings may show through the subsequent workings; in other words, that the yellow may be seen through and its effect combined with any of the red and blue which may be printed over it, and that the red may be seen through and its effect combined with any of the blue which may be printed over it. To attempt tri-chromatic work with opaque inks would be disastrous.

Any reader who desires to follow up the science and art of Three-colour Printing more closely is recommended to study such a work as *Tri-chromatic Printing*, by Mr. Zander, published at 2s. 6d. by Messrs. Raithby, Lawrence, & Co.

CHAPTER LXXXVIII.

FLOCK OR VELVET PRINTING—Gelatining—Transparency Printing.

Flock or Velvet Printing.—This branch of printing is chiefly used for show cards. It is simple, yet produces excellent effects.

Flock is finely-powdered wool, the darker shades being generally made from old woollen rags, and coloured in every imaginable shade. The colours are very bright, and when worked in combination with coloured inks, bronze, etc., some beautiful effects can be obtained at very slight expense.

This class of printing is best done from engraved blocks showing a dark background, with the letters cut out, but is also adapted to type printing, care being taken to have no small letters in the forme, as the flock sizing, being heavy and extremely hard to distribute, has a tendency to fill up fine lines or cuts.

If the size, when taken from the can, is too heavy, reduce with Damar varnish, which will thin the body of the size without destroying its adhesive qualities. Prepare the size in small quantities, as it is needed, or it will become dry faster than it can be worked up; and in all cases when a size is being used, be careful to use a roller that has a hard, dry face. Never damp the roller just before putting it to the size. The roller should be cleaned at least once an hour during the time it is in use, and always as soon as the job is finished, the best wash for the purpose being spirits of turpentine, finishing up with a sponge

damped with clean water. The forme will also be much benefited by an occasional cleaning.

Provide, say, a quarter of a pound each of the following colours of flock: Light blue, light green, crimson or scarlet red, purple, and yellow; a pound of flock sizing; a half-pound of isinglass or frosting; some bronze; and a few ounces each of the following dry powders: Ultramarine blue, Paris green, and a good vermilion. All of the above articles, with the exception of the size, may be had from the oilshops or drysalters, and the size is manufactured by ink-makers. As jobs of this nature are generally done in small numbers, it is best to print them on a press.

After the forme has been prepared, mix the size to suit, roll, and take the impression the same as if for a job to be done in bronze. If bronze is to be used at the foot of the lines, with a camel's-hair brush apply that first, then with the fingers throw on such colour or colours of the flock as may be desired. Take the card into the tips of the fingers, and bounce it until the flock has spread all over the impression, and then shake off the surplus powder into a box, or on a sheet of paper provided for the purpose, and the job is done.

If the frosting is to be used, let it be beaten up as fine as possible; throw it on to the impression *before* the flock is used, and shake the surplus powder off. This will show a frosted appearance through the flock, and is very beautiful.

When the dry powder is to be used, it must be applied with a brush the same as the bronze, and when all four of the articles are to be used on the same impression, they should be applied in the following order: First the bronze, second the dry powder, third the frosting, and last the flock. The surplus powder thrown off can be worked up on an occasional card, to prevent waste.

By a little practice the printer will be enabled, with the above directions, to produce some very desirable effects,

and can, with very little expense over and above one-colour printing, give as many colours as he pleases from one impression.

When flock jobs are done in large quantities, and for such classes of goods as are liable to be roughly handled, the impressions are calendered after the flock has been applied; but for jobs that are to be hung up and not hardly used it is not necessary.

Gelatining.—Show cards in gold and colours are often improved by being *gelatined*—a simple operation, which is usually performed in the printer's warehouse.

Procure several tablets of flatted ground glass, cased in wooden frames. A rack should be set up to contain these tablets, which should each have a distinctive number and an allotted place in the rack. The manipulation of the process should be in a room where little or no dust is made. The framed rack should be built with 3-in. strips of wood, like a drying-rack for gumming envelopes, the back part fastened to a smooth wall, and the under part or bottom covered with pasteboard. The different compartments in the rack must be made exactly level; and it is best to have them levelled with a spirit-level, so that the requisite horizontal position of the glass tablets should be exact, without having recourse to packing up. If this is not done, the covering of the fluid material will not be altogether equal.

The gelatine itself, which is a white glue made from bones as well as the offal of tanners, is sold in thin and nearly transparent slabs. The Chinese gelatine, which is obtained in the form of folded tubes, and is of a very white light substance, of vegetable origin, can only be dissolved in boiling water. Ordinary gelatine is thus treated: It is first broken up into small pieces, then put into a clean linen cloth, and suspended (still in the cloth) in a basin of water, which is put in an open crucible, and then sub-

mitted to the heat of a spirit-lamp, by which the gelatine is dissolved by the boiling water and the impure parts remain in the cloth. The quantity of water and gelatine should give a light, easy fluid, to which an equal part of spirits of wine is then added, as without this addition the fluid poured on the glass tablet would soon get cold and spread unequally, while by means of the spirits of wine it levels equally and easily. The most suitable mixture for this is: gelatine two parts, water five parts, spirits of wine three parts. But the vessel containing this fluid, after the addition of the spirits of wine, should be covered up, in order that it may not evaporate. It is also necessary that a glass vessel, provided with a measuring scale, such as chemists have, should be used, so that you may be enabled to judge how much of this fluid gelatine is necessary for a tablet in order not to get too weak or too strong a cover. Before the pouring out the glass tablet should have a slight coating of oil on the surface, to prevent the sticking of the gelatine to the tablet.

The subsequent manipulation consists of the following: After the requisite quantity of gelatine has been poured into the graduated glass it is poured on the slightly oiled glass tablet in a semi-warm state, whence it assumes a syrup-like consistency, and then the tablet is moved gently to and fro until all parts of it are covered by the gelatine fluid, when it is put in its place on the rack, and then, in a similar manner, all the other tablets are regularly treated.

After a quarter of an hour, when all the fluid mass on the glass tablet begins to get consistent, the picture or ticket which is to be gelatined should be moistened with water on its back with a sponge and the gelatine put on. Any air-bubbles which may arise in covering should be pressed out with the hand towards the edges, and care should be taken that the edges of the picture adhere well.

In this state the sheets should remain for two or three days, lying on the rack until they are completely dry, when, with a blunted or dull knife, the surplus gelatine at the edges is cut away, and the card, which now adheres fast to the gelatine, is taken off the glass tablet.

It should be understood that the frame and glass of the used tablets must be carefully cleaned from the adhering gelatine before they are used again.

Transparency Printing is a class of work in which advertisements are printed in one or more colours, so that they may be pasted on glass windows.

The coloured inks may be procured ready made, the manufacture of Messrs. Kast & Ehinger, of Feuerbach-Stuttgart, being the best known. They are of great clearness and brilliancy, and altogether supersede the slow preparation hitherto necessary to give the transparent quality to the paper. With these colours the design is printed on a thin wove bank paper. Each colour has to be printed twice, in order to give it the necessary depth. When the sheets are printed and the last colour dry, transparent varnish supplied for the purpose is poured into a flat, open pan, and the printed sheets are drawn through the varnish, so that the paper gets equally wet on both sides. They should then be hung up to dry in a room free of dust, and in such a position that they will not stick together. The varnish should be kept well corked, to prevent its evaporating.

BOOK IV.

THE WAREHOUSE DEPARTMENT.

CHAPTER LXXXIX.

WAREHOUSE.—Machinery—Accounts—Drying the Sheets—Cold Pressing—Hot Pressing—Hot Rolling.

AFTER the paper has been printed by any of the methods referred to in the previous pages, it is sent to another department of the printing-office, and operated upon by a distinct class of operatives. This department is called the Warehouse, whose operations now have to be described.

In the warehouse the printed sheets are counted, and, where those operations are required, dried and pressed. They may also, according to circumstances, be folded, collated, cut up, again counted, parcelled, and delivered to the customer, unless they are to be stored. They may, on the other hand, require to be immediately bound up, in which case they go to the binding-rooms. In the warehouse, too, are kept the various kinds of paper and card which may be wanted by the pressmen. It should therefore be well provided with proper racks, cupboards, and pigeonholes, and everything in it should be kept in an orderly and methodical manner.

Machinery.—The apparatus required in a warehouse largely depends upon the class of work done in the establishment, and the scale upon which business is carried on. It may include screw or hydraulic presses, folding, cutting, and sewing machines, and various special appliances hereafter to be referred to. The presses are best fixed to the floors, resting on solid foundations, and

supported by trusses or stays running from floor and ceiling. Screw presses, and hydraulic presses in particular, are very massive, and cannot always be used to their full strength unless they have special foundations. Cutting machines, especially those which are self-clamping, are also exceedingly weighty, and it requires some consideration to determine the place where they can be set up so as best to perform their work. Folding and sewing machines are lighter, but they require to be more carefully protected, as valuable work may be spoiled on them if the necessary precautions against dust are not taken. Above all, everything must be kept in the most cleanly condition. There must be no excuse for dirt in the warehouse, and this applies to the hands and clothes of the operatives as well as to the machinery.

Entering the Work.—It is a rule in the warehouse neither to receive nor to part with even the smallest quantity of paper without proper written authority. Even when this authority is received it must be filed, and whatever is done in accordance with it must be duly recorded in the several warehouse-books. The warehouseman must be ready at any time to state accurately how much white paper and how many copies of any given printed sheet he has in stock. It is obvious that it is only by a proper system of bookkeeping, rigorously carried out, that this end can be accomplished. In large offices the bookkeeping is done by the warehouse clerk, and the direction of the hands employed alone occupies the principal warehouseman.

White Paper.—This sort of paper, as previously explained, includes all kinds of stock not actually printed. It will be brought in from the stationers, together with a delivery-note stating the number of reams, bundles, or reels that ought to be sent. The delivery-note is compared with the material, the parcels-book of the carter

signed, and some of the hands arrange the parcels in a convenient place in piles. Then the quantities are entered into the stock-book, and the paper can be opened and stored.

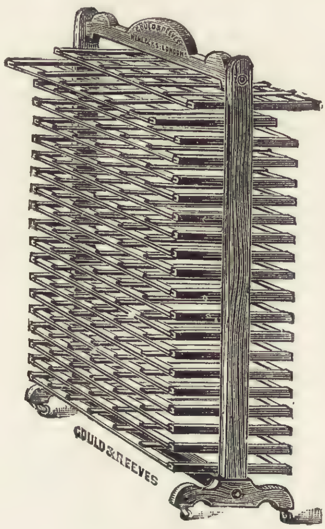
At the appointed time the warehouseman receives from the foreman of the machine or press department a note requiring the delivery of a certain quantity of paper. This must be attended to, and a receipt obtained for the quantity of the paper that is given up, which receipt will be filed or passed on to the clerk to be entered in the stock-book. While the warehouseman is debited with all paper received, he is, of course, credited with what he delivers to be printed. Great care should be taken not to run short of paper for any job whose recurrence is known beforehand, such as the ordinary issues of a periodical, carelessness in this respect being regarded as a most serious offence. When the number of copies of a periodical is understood, the manager is supposed to confide in the warehouseman that he always has sufficient paper in stock, both for the edition and any probable extra demand that may arise; and if he has not enough paper, that he will at once acquaint the proper person of the fact.

Drying the Ink on the Printed Sheets.—When, as is usual, the paper is printed dry with quick-drying ink it not infrequently happens that the ink on it is dry before it leaves the machine room; but when this is not the case, or there is any doubt about it, the sheets are to be removed carefully, and not too many together, and spread about the room, or on one or more of the drying racks sold for the purpose.

There is always danger that while the ink appears on the surface to be dry and "set," it may be more or less wet beneath. If a smear results from the finger being slightly rubbed over it, of course the sheet must be kept

hung up for some time longer; but it is best to test one of them by laying over it a piece of printing paper, and rubbing the back of that with a paper knife. If, when removed, there is no set-off, it may be taken for granted that the sheets are ready to be pressed or sent out, as the case may be.

Ink dries most rapidly on a well-calendered printing paper. Some of the hard writing papers used occasionally



DRYING RACK.

for printing upon require to be exposed for many days before they are thoroughly dry.

Artificial Drying of Ink.—If it be necessary to dry a few printed sheets immediately, for any sudden emergency, such as completing the sheets of a volume, calcined magnesia may be dusted over them, which will not sensibly affect the colour of the ink, and yet remove or absorb so much of it as remains above the surface of the paper.

A pad of cotton wool is preferably employed, and the ink may then be rubbed over as in applying bronze powders. Powdered French chalk is also useful, but it makes the paper very slippery.

When the printed sheets come from the press room they have again to be counted and recorded, and a receipt given for them. After they have been folded, or pressed, or stitched, as the case may be, and before they are "sent out," they must again be counted, a record of this transaction being also necessary—so that at least four separate entries have, in a well-ordered warehouse, to be made concerning each lot of paper. The nature of these entries and models for the forms required are given in the chapter on "Bookkeeping."

Drying Wet Sheets.—This is a work which has not often to be performed now, for, as already stated, the wetting of paper is out of date and is resorted to only when absolutely needful. The printed sheets are brought from the machine-room and stacked upon the floor, or on shelves or benches, preparatory to being dried. By means of the hot-rolling machines, presently to be described, sheets may be pressed almost immediately after being taken from the press; otherwise drying is the first operation which the warehouseman will undertake. Of course, when paper is worked dry, it is the ink on it only which has to be dried, and this takes less time than it used by the employment of quick-drying inks.

In very small offices cords or lines were strung across the press-room; hence the phrase, "on the line." The paper was laid upon them by means of the "peel," a strip of wood to which a cross-piece was attached. It is a prominent feature in engravings of old offices. A better plan was to erect poles or rods near the ceiling of the warehouse. After hanging the sheets up in parcels of a quire or so they were left to dry by the ordinary evaporation

of the moisture. This plan was open to three serious objections. It was dangerous, as the gaslights, often placed close by, were liable to ignite the sheets, and perhaps set fire to the whole building. It was also defective from the tendency there is of the dust of the room discolouring the paper, particularly over the fold, or the "break," more especially as the exposure must be maintained for a considerable time. The plan also detracted from the orderly and methodical appearance which should always be exhibited in the warehouse.

It is believed by most printers that the very finest kind of work, when executed on damp paper, can only be dried properly in cold air. The process is slow and tedious, and involves much space. The best plan is to lay out the sheets in twos or threes upon trays, or on one of the drying racks above-mentioned. If there are very heavy cuts the set-off sheets ought to be left in as they come from the machine.

The best way of drying sheets, where it is practicable, is to use hot air or steam pipes. A room with stone or brick flooring and bare walls is the most suitable, as even with the greatest care there is always the danger of fire breaking out.

A good arrangement is one which may be described as a series of domestic clothes-horses standing nearly together and closed up. Their front edges are wider than the rest of the frames, and approach each other quite closely, so that when all are in position the side of the series forms a complete partition. By making them run in grooves one horse may be withdrawn at a time and the sheets moved and replaced, the rest of them meanwhile not being exposed to as much cold air as if a wide door had to be opened. In such a room the work should be hung in quantities of about half a quire, although sometimes smaller and sometimes larger lots are better.

The temperature of this room may be about 125 degrees, but this is a matter influenced by the character of the work, and one which experience alone can settle.

Removing Blemishes.—Very fine work when received from the printing office is generally examined, sheet by sheet, to ascertain whether there are any finger-marks or smears on the margin. Such may be removed by the use of stale bread, india-rubber, or an ink eraser ; but fine glass or sand paper is also occasionally resorted to.

Pressing.—When ink and paper are thoroughly dry, the work is ready to be pressed, and thereby freed from the indentations caused by the pressure of the types. It is usually held to be desirable that these should be removed, and that a perfectly level, polished surface should be given to the paper. In America and with most printers here, the acme of the printer's art is supposed to be reached when every trace of the pressure of the types has been removed, and the sheets present the smooth and glossy appearance of polished ivory. Connoisseurs of fine printing in France —the home of bibliophilism—on the other hand, rather prefer to see the effect of the pressure, and do not admire the high glaze so much valued elsewhere.

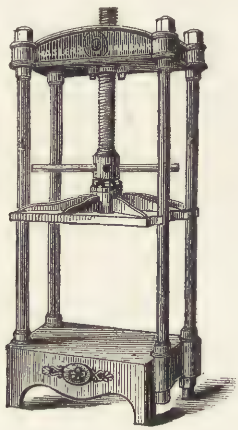
The general adoption of hard packing and the greater care bestowed upon printing of late years result in good work showing little if any indentation, and this being so, pressing is seldom resorted to.

There are two distinct pressing processes, called respectively "Cold Pressing" and "Hot Pressing." Machines are constructed according to the requirements of both methods.

Cold Pressing.—The earliest system adopted was to beat the printed sheets with a heavy hammer—a tedious and laborious process, and one requiring great dexterity. After this there was introduced the screw press. The smallest and most elementary appliance of the kind is called the

Nipping Press. It consists of a frame with cross-piece, into which a screw is wormed, to the end of it being attached a platen. The paper is placed underneath this, and the action of the screw bringing down the platen causes the necessary pressure. The Nipping Press, of which the well-known office press for copying letters is an example, is, of course, only suitable for small jobs, and it is made up to about twenty-four inches in length.

The *Screw Press* or *Standing Press* is a development of



STANDING PRESS.

the last named. The sheets are placed either singly or in lots of three or four between "glazed boards." The process involves the handling of the sheets twice—first, in laying them between the boards and putting them in the press, allowing them to remain a number of hours to obtain the desired surface and finish; second, the removing of the sheets from the press and taking them out of the boards.

The *Glazed Boards* are made in various sizes and thicknesses. They are somewhat costly, but only the best ought to be used, as they are more economical than the thin

descriptions. For "filling in" the boards, two boys or girls are employed. One stands before the pile of paper, another on his left before the pile of boards. One lays down a board, the other instantly deposits on it a sheet, immediately after which the first lays down another board, and so on, till the whole of the paper is between boards. The heap is then taken to the press and placed on the bottom or bed. The arm—a long lever—is then placed in the hole left for it, and by thus turning the screw the whole is pressed. The piece answering to the platen of a printing press is called the "follower;" the space between that and the bed is called the "daylight." Some screw presses are actuated by a three-limbed appliance like the three legs in the arms of the Isle of Man, and are called "Athol presses."

The warehouseman should be very particular to ensure that the work is thoroughly dry before it is put into the press. If this be neglected, there will be a set-off on the glazed boards, which will reappear on a subsequent lot of sheets being set in.

The Hydraulic Press.—The deficiency of the screw or standing press consists in the fact that it is impossible to get sufficient pressure from it for certain kinds of work. Hence there was invented the "hydraulic press," which is sometimes called after its originator, Bramah, the engineer. It depends upon the principle that a pressure exerted on the surface of a liquid is transmitted undiminished to all parts of the mass and in all directions. We must omit details of construction, but the following are the essential parts of the machine: Into the cavity of a strong metal cylinder a piston passes, but watertight through the top. A tube leads from the cylinder to a force-pump, and by means of this water is drawn from the tank into a cavity, so as to force the piston upwards. The piston supports a table, on which is placed the paper to be pressed, and the rising of the table presses the mass against a strong cross-

head, fastened to the side pillars of the press. The power of the press is calculated in the following manner: Suppose that the pump has only one-thousandth of the area of the piston, and that by means of its lever-handles the piston of the pump is pressed down with a force of 500 pounds, the piston of the barrel will rise with a force of one thousand times 500 pounds, or more than 200 tons. The rise is slow, and varies in proportion to the power. The chief disadvantage of the hydraulic press is that it "gives" after impression is put on. This, however, usually occurs with what is called "spongy" work; that is, soft piles or "stacks" of paper whose compressibility is greater than usual. When the stacks are put in "solid," the pressure is maintained.

The enormous multiplying power given by this machine has been employed for many years in the printer's warehouse, presses suitable for printers being made of various sizes up to quadruple demy, which can be pumped up by steam or hand power. It is found advantageous, when a number of presses are used in an office, to employ steam. An eccentric should be fixed to the shafting. Any number of presses may be served by a single pipe, by having a joint at each press fitted with a screw valve, which can be opened or shut at will.

Hot Pressing.—As a process for finishing sheets by removing the indentations of the printing, and imparting smoothness and glossiness to the paper, hot pressing has certain advantages over cold pressing, especially one, arising from the fact that the work is done in considerably less time—a matter occasionally of the highest importance. On the other hand, unless hot pressing is properly done, it may spoil instead of improving the appearance of the sheets subjected to it, especially by browning the ink, making it spread, and by causing set-off. The following are the methods adopted by the professional hot pressers.

The Press.—The presses that have given the best results hitherto are the hydraulic press and presses made with screws operating knuckle-joints. The ordinary screw press is not powerful enough.

Arrangement of the Press.—On the bed of the press about twenty glazed boards, or "cards," or "skins," as they are often termed, are first of all laid down to form a firm foundation. Then there is laid on them a heated iron plate, about ½ or ¾ of an inch thick. Above that comes the stack, consisting of sheets of the paper alternated or "sandwiched" with glazed boards. About 130 glazed boards form a stack. Above them, again, comes another hot plate, and then, according to the available space, another stack and another heated plate, twenty or thirty cards being laid on the top of all. The "follower" is now nearly reached, and the action of the pump and piston below the bed forces the latter up, and causes the impression. This filling of the press is called "building up," and it has to be done with the greatest rapidity, otherwise the plates would get cold.

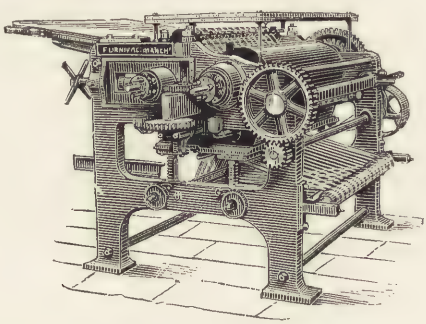
Heating the Plates.—This is done in a specially contrived oven, with a damper at the top, which is opened for the admission of cold air if the plates have become too hot, or, in technical language, are "over-baked." To know whether the plates are hot enough, the workman applies his finger, covered with a little saliva, in the same way as tailors are accustomed to test the temperature of their irons. If the saliva is at once evaporated, the plate is hot enough.

Building up.—The whole of the stacks must be put in the press together, to prevent the plates becoming too cold. They are kept in the press from eight to twelve hours; in the former case it would be called an "eight-hour press," in the latter a "twelve-hour press."

The Boards.—One sheet only is put between each glazed board. The boards should not be too thick; if they are,

much of the force of the impression is lost. The boards are expensive, but practically they may be said to never wear out.

Cleaning the Boards.—In the pressing some of the ink gets transferred to the boards. Whenever it is thought that there is danger of set-off from them the boards need only to be "baked," or exposed to a moderate heat in the oven for heating the plates. The effect of this seems to be to indurate the board with printing ink, which, even with the finest work, never sets off.



GILL HOT-ROLLING MACHINE.

Filling in.—The boards may be filled in with sheets in the way already referred to under the subject of Cold Pressing. Professional hot pressers have a more rapid method described in earlier editions of this work, but as hot pressing is so seldom resorted to now it is not considered worth while to explain it.

Hot Rolling.—Both hot and cold pressing were to a great extent superseded by hot rolling, which takes very much less time. The process consists in passing the sheets between two smooth-surfaced and heated cylinders, whose surfaces are brought very close together. The machines which in this country are generally used are that invented

by Mr. Gill and made by Messrs. Furnival & Co., and Messrs. Duncan & Salmon's machine. The speciality of these machines is that by means of them work may be finished almost directly after it is taken from the machine, the drying and pressing or "rolling" the sheet being done at one operation.

The Gill machine consists of two polished steel cylinders, which are heated by steam or by gas flames. At the upper end is a feeding-board, on which the sheets to be rolled are laid, and at the other end, under the cylinder, is a delivery arrangement, consisting of travelling tapes, which convey the sheets to a receiving board. The machine can be set up by any engineer, as all the parts are carefully marked.

After the machine is erected, and before commencing to run paper through, care should be taken to ascertain that the points for removing the sheets from the rolls are set so that each point touches the roll. The machine may then be started, and the points worked up to a feather edge. When this is done there will be a slight burr on the ends of the points, which must be removed by means of a little emery cloth on the fingers. Then remove the bolts, which go through levers at the ends of the point bars, and by which the points are pressed against the rolls, and substitute for them the elastic bands sent with the machine, as, after once being bedded, the points must only be pressed against the rolls with a slight elastic pressure, otherwise they will have burrs produced on them, which will stop the delivery of the sheet.

If it should be found that sheets occasionally catch the points, it will be evident that some of the points have not been sufficiently bedded, or the burrs have not been thoroughly removed, and they must be allowed to work a little longer before passing any more sheets through.

The solution for removing the set-off from the rolls consists

of common soda and water, in the proportions of one pound of soda to one gallon of water ; and the solution is ready for use after standing about ten hours. If the ink is very greasy, a stronger solution may be necessary. The addition of a little of "Hudson's Dry Soap" is found beneficial in keeping the rolls bright.

When the machine is working constantly, the sponge-bags in the troughs must be turned at least twice a day, and thoroughly washed once a week; or a piece of old blanket should be placed on the top of the sponge bags and washed every night. The troughs should be emptied and thoroughly cleansed at least once a month.

When the machine is stopped for any length of time, say all night, the trough containing the solution must be taken out, and the pressure removed, so that the rolls are not in contact. The rolls should be cleaned thoroughly dry, and wiped over with a greasy cloth, or a little mutton suet, so as to prevent any corrosion or rust, to which chilled rolls are especially liable. This is most important, as the rusting of the rolls will necessitate their being taken out and reground, which is a very costly process.

Paper may be thinned by this machine to an extent that is quite surprising. One edition of the London Post Office Directory was thus reduced in thickness about an inch and a half.

Disadvantages of Hot Pressing and Hot Rolling.—Though hot rolling and hot pressing have their advantages, they have disadvantages too. Some of the colour is always removed. Then if the plates or rolls are too hot the ink will spread or blur, and it will also turn brown. If fine printing is to be pressed at all it should be pressed by the cold process.

Pressing after Folding.—In some American offices machines are used which press book sheets after they have been folded, and Mr. De Vinne says he much prefers

this method to any of the ordinary modes of treating the sheets after printing. In this system the sheets, after drying, are folded to the size required, and these, a hundred or more at a time, are squeezed by a special hydraulic press constructed for the purpose. Obviously the ink must be quite dry before this pressure is given.

CHAPTER XC.

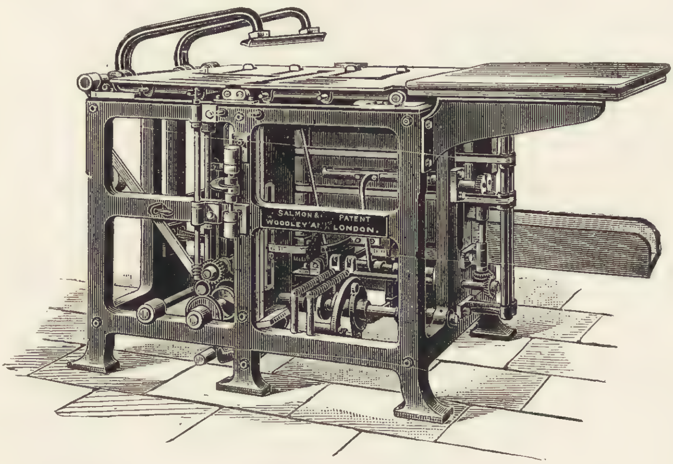
VARIOUS WAREHOUSE PROCESSES.—Folding—Knocking-up—Gathering—Collating—Counting—Cutting of Paper and Cards—Paging—Perforating—Ruling—Sewing and Stabbing—Eyeletting.

Folding.—If the sheets in hand consist of bookwork, they have to be folded. This is done either by hand or machine.

Machine-folding requires few directions. The machine must be adapted for the method of imposition adopted by the compositor or pressman, or this altered to suit it. The sheets are fed into the apparatus as in a printing machine, receive their folds from the mechanism inside, and are delivered at the bottom, all that is necessary being to remove them whenever the pile has become sufficiently large. Some machines register by points, as in printing; in others the work is merely fed up to gauges. The alteration of the apparatus for two, three, or more folds is done according to the directions for use supplied by each manufacturer, which are applicable only to his particular machine; hence it is unnecessary to reprint them here. Care should be enjoined upon the operator, usually a young woman, that her hands are clean, and that the sheets be as little handled as possible, lest smears be caused.

The machine is usually constructed with knives and rollers, and the folds are generally obtained thus: A sheet is fed in; it travels horizontally till its middle is just over the opening between two rollers revolving horizontally, then a knife descends and forces it between those rollers, thus making the first fold; it now travels downwards between tapes,

and opposite two rollers revolving vertically, on the other side of it being a vertical knife ; at the proper moment this knife strikes across the middle of the once-folded sheet, and by forcing it between the two vertical rollers gives the second fold; a similar process with another knife and set of rollers will give a third fold, and then the folded sheet is delivered into a box. In some machines the sheets travel vertically first and horizontally afterwards.

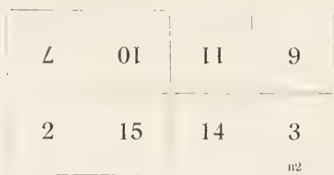


FOLDING MACHINE.

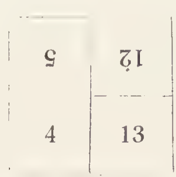
Hand-folding is an operation requiring both precision and dexterity, qualities of a somewhat diverse character. The operator must fully understand the object and uses of signatures, as described in the early part of this work. There is a different method adopted for each form of sheet —the quarto, octavo, 12mo, and the rest, each requiring special treatment. The general system, however, may be gathered from the following account of the folding of an *octavo* sheet, the form which is now in the great majority of instances preferred.

Take a pile of about five hundred sheets, and lay them out flat on the folding-board. If any of them are irregularly piled up they must be brought to lie exactly on the top of each other by being "knocked-up," as will be described hereafter. It is most essential for proper folding that the pile should be perfectly straight and square.

Now take a sheet and turn it so that the *inner* form is uppermost—that is, the side containing the second page of the sheet. The principal signature will be underneath ; but the secondary signature, such as B 2 of sheet B, will be exposed to view, and be on the extreme right hand. The order of the *printed* pages will now be as follows :—



At the foot of 3 will be the second signature. Now fold the half of the sheet containing pages 3, 6, 11, and 14 entirely over the half, and stroke down the line of the fold. Stroking is done with a smooth piece of bone which is something like a thick paper knife. It may be that the off-margins of pages 2 and 3 are not exactly equal, but that must be disregarded, and the pages of the print themselves made to fall exactly over each other. The following pages will now be uppermost :—



Bring that half of the sheet containing 5 and 12 over upon the top of 4 and 13, and stroke the fold. Now there are presented only pages

8	9

Fold 9 over 8, and page 16 will be exposed, the folding being now finished. With the left hand remove the sheet to the left side, and commence folding the next.

The right hand is used for turning the sheet and stroking down. The adjustment of the pages, or making them register, is done with the left hand immediately before stroking. The sheets ought to be well flattened, or they will give subsequent trouble, and it is advisable to have large pieces of wood on the folding-table to keep the pile straight.

Knocking-up is a simple operation, yet somewhat difficult to describe verbally. Its object is to get the sheets to lie exactly on the top of each other in an even pile—in non-technical language, to make all the edges coincide. Take up twenty or more loosely between the two hands; place them on edge, lift the lot up, and bring them down smartly on the board; by which the bottoms of all will be made regular and even. Then, without disturbing their position in that direction, turn round the lot and bring the other edge against the table. This will probably bring the whole pile right; if not, it must be turned again until all the refractory sheets have assumed their proper places. Knocking-up is always done on the backs and heads, so that these may lie evenly, the tails and fore edges being left uneven.

Although properly appertaining to Bookbinding, the two operations of Gathering and Collating may be briefly described.

Gathering.—The several sheets of a volume, having been

folded and otherwise finished, have now to be brought together in due order and sequence. Each signature is laid out in a pile on the board of the warehouse, and the gatherer begins with taking a sheet of the last signature, then one of the last but one, and so on till all have been exhausted. It does not always happen that the stock of printed sheets "runs level"—there will generally be a few more of some sheets than others. The actual number of books is, of course, the number of complete sets of sheets that can be gathered. All sheets remaining are designated as waste.

The *Rotary Gatherer* is an arrangement for economising space and labour. It consists of a large circular revolving table, around which, near the edge, are placed in order the different sheets in piles. Around this table are a number of square tables, and at each stands a boy or girl. The persons gathering have merely to stand still, each in his place, and each pile will be successively presented to him. He takes one sheet from each and places it on his table. Several persons may thus simultaneously gather at the one machine, as the piles will pass each of them in succession.

Collating is simply examining each set of sheets to ascertain whether it includes one copy, and only one, of each signature, and that all the sheets comprised in it are in proper order. The operator takes up the lot by one corner in his left hand, by which means the sheets are slightly separated, and the signatures exposed. He runs his eye over them, and instantaneously detects any inaccuracy.

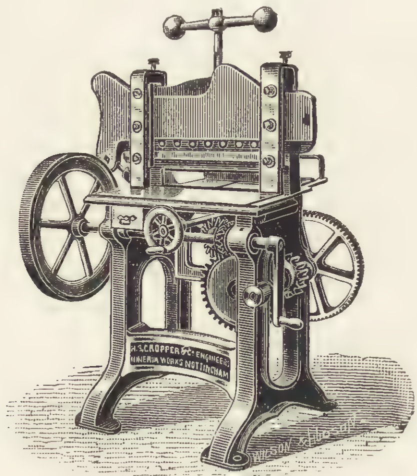
An excellent method to ensure the correctness of the gathering and to entirely obviate the necessity of collating is to let the man who makes up the formes insert a piece of nonpareil rule, two picas in length, exactly in the centre of the furniture, between the first and last page of each sheet. For sig. B this should be placed so as to touch the

footstick, in sig. C it should be two picas higher, sig. D four picas higher, and so on. When the sheets are folded and gathered properly the black line runs unbroken along the backs. An omission or a double would at once be detected.

Counting, as we have already said, is one of the most frequent operations in the warehouse, and it is of the greatest advantage to be able to do it properly—that is, methodically, rapidly, and accurately. The process is very simple, yet difficult to describe; and the best way to learn it is to watch some experienced hand. A sufficient quantity of sheets—which practice alone can indicate—are taken in the right hand; then by a dexterous turn of the wrist, they are separated fan-wise, so that the edges of each are distinctly seen. The left hand is laid on the top corner, a certain number of sheets are counted by a glance of the eye, and the left thumb introduced. The hand is now advanced so as to keep this portion a little back, while another portion is counted and the thumb introduced, and so on. The rapidity with which this is done by an expert seems marvellous to the inexperienced. The thumb seems mechanically to travel through the successive portions; and there appears to be no mental calculation at all on the part of the operator. The only directions we need give on this subject are, not to attempt to count by too many numbers—five being the most convenient portion—and always to count by the same number.

Cutting is done by hand and by machine. By hand the process is quite simple, and, indeed, understood by nearly every one. To do the work really well, however, requires care and practice. The paper must be carefully folded down and smoothed with the paper-knife; a proper cutting-knife well sharpened must be used, and the cut given firmly and continuously; otherwise the paper will be "saw-edged," and require to be trimmed. It is only in very small printing offices indeed that hand cutting is practised.

Cutting at the machine is also a simple operation, requiring little instruction. The ordinary guillotine cutting machine has a table on which a well-knocked-up pile of paper is laid. The pile is then pressed back so as to come under the knife, being kept in position and supported at the back by a movable guide, worked by a handle underneath the table. It serves also to ensure a square shape to the paper. The clamp is then brought down by the gearing provided for

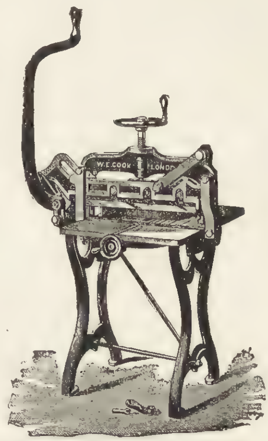


GUILLOTINE MACHINE.

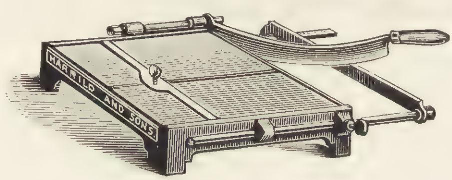
the purpose—generally a screw with ball-ended arms, as shown in the illustration—and finally the handle is turned and the knife descends. When it has made the cut the knife reascends automatically, and when up the wheel is stopped. Some machines are *self-clamping*, that is, the clamp has not to be screwed down as in the machine described, but descends and holds the sheets automatically, releasing them again as soon as the cut has been made. These last are generally large and ponderous machines

worked by power. Guillotines for small offices are made to work with a lever as shown in the illustration. They are cheaper than those actuated by wheel gear.

Cards, being very hard, are generally cut singly from the sheets of cardboard by means of the cutter shown in the illustration. To the right of the knife is an adjustable stop or gauge, fixed by means of clamp screws at such a distance from the knife as will give the precise length or width of card desired. The workman first cuts a thin strip, if this be needed to get a perfectly straight edge, and then he presses that edge up to the gauge and cuts again, repeating the process as often as necessary till his strip of cardboard is exhausted, when he takes another.



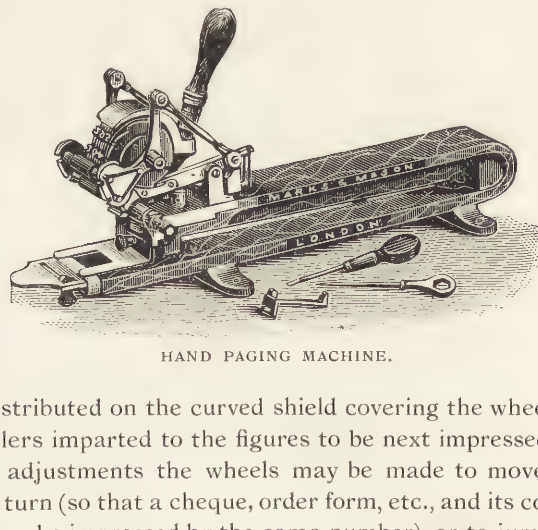
LEVER GUILLOTINE.



CARD CUTTER.

Paging.—Many jobs, such as cheques, order forms and delivery notes, which are made up into books require to be paged or numbered consecutively, their counterfoils being similarly numbered. This work is done after printing by paging machines, which are worked either by hand or treadle. They consist of a number of wheels, each bearing the numerals 0 to 9, and they are so arranged that one

numeral of the right-hand wheel, with or without one of one or more of the other wheels, impresses the work each time the wheels are lowered, which they are either by the hand or by treadle, and the mechanism—generally a ratchet and pawl motion—of the machine is such that after each impression the figure on the right-hand wheel is changed, figure 1 of the wheel next it coming into play after nine impressions from the first wheel have been made, figure 2 taking its place when nineteen impressions have been made, and so on, the third wheel coming into action after 99, the fourth after 999, and so on. The figures are inked by printing



HAND PAGING MACHINE.

ink distributed on the curved shield covering the wheels and by rollers imparted to the figures to be next impressed. By slight adjustments the wheels may be made to move every other turn (so that a cheque, order form, etc., and its counterfoil may be impressed by the same number), or to jump from 1 to 3, 3 to 5, or 2 to 4, 4 to 6, and so on, so that all *recto* pages may be done at one time and all *verso* pages at another. Where much paging work is done the treadle machines are the best, though for ordinary purposes the hand pager shown in the illustration is generally used. For small work small hand pagers like dating stamps are now obtainable.

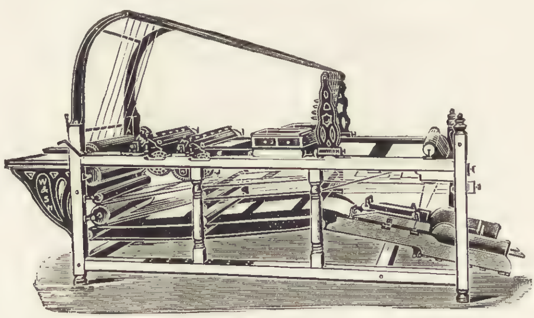
Perforating.—Work like that last mentioned requires to be perforated, that the cheque, order form, etc., may be severed from its counterfoil. This work is done after printing by a perforating machine which generally consists of a table and a beam of iron above it, along which is a row of pins which, when the treadle is depressed, descend into holes made to receive them, little holes being punched in the interposed sheet of paper at the same time. On releasing the foot a spring restores the beam with its pins to its former level ready for another sheet. Adjustable gauges

TREADLE PERFORATOR.

for the back and side edges of the sheet to be perforated are added to the table, and in the best machines the pins are in sections, so that some may be removed when the work requires that the perforation should extend only partly across the paper. There are small machines worked with a hand lever, and also rotary perforators in which the perforating is done by pins borne on the periphery of one wheel and falling into holes in the periphery of a corresponding wheel placed below it and revolving with it. Rotary machines sometimes bear several wheels on the same axes, adjustable to varying distances, and thus several

perforations of a sheet at the intervals desired may be made with them at the same moment.

Ruling.—The ruling of invoices, statement forms, and memorandums is done nearly always before the letterpress on those jobs is executed. It is effected by ruling machines, a type of which is here illustrated. The paper is fed into the machine to side guides, and travels on an endless band or blanket under a row of ruling pens adjusted to proper distances and fixed into a horizontal bar or "pen-holder," along which runs a fluid ink specially made for the purpose, a limited quantity being supplied to each pen. As the paper



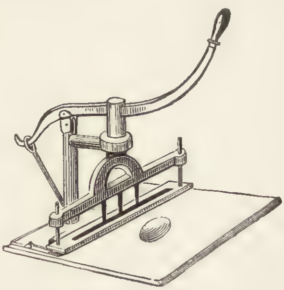
RULING MACHINE.

passes under the pens, each leaves its line upon the paper. Stopped lines are provided for by the raising and lowering of the pens at the required intervals, for it is only when they touch the paper that they mark it. The raising and lowering are done either by the hand or the foot of the person operating the machine, or automatically by means of simple mechanism. The strings shown in the cut are for the purpose of accurately guiding the work through the machine.

Sewing, Stabbing, and Wire Stitching.—Though the fastening together of sheets is properly bookbinder's work, it often has to be done in a printing office, to the warehouse of which a small binding department is often annexed.

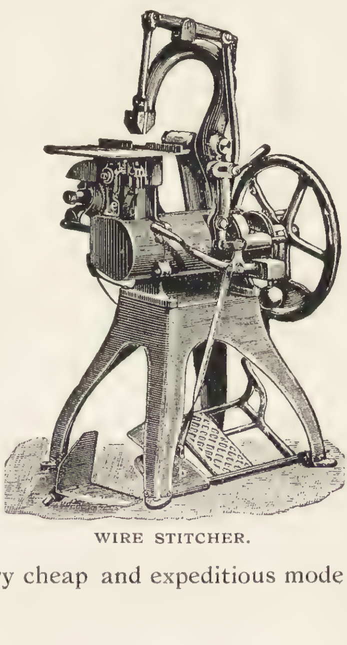
Pamphlets are either "sewn," "stabbed," "wire stitched," or "stapled."

Sewing is done with thread exactly in the back folds of a sheet, which is opened for the purpose. It is generally done by hand, though there are machines for book-sewing.



STABBING MACHINE.

Stabbing is done with a press like that shown. The sheet or collected sheets forming the pamphlet are placed on the table so that the backs touch the back gauge, and when the lever is pulled the three pins make holes through the sheets about a quarter of an inch from the back folds. Subsequently women with needles and thread string the sheets together through the holes and fasten them off with a knot.



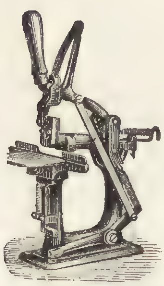
WIRE STITCHER.

Wire Stitching is done in the fold of each sheet, generally in two places. Fine steel wire on a reel is, by means of a press, driven through the sheet and clamped on the back, each stitch being separate, that is, the wire is cut at each fastening. There are several forms of these machines; one much in use in printing offices is shown here.

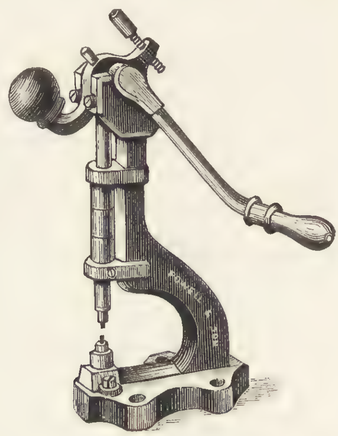
Stapling is done with wire through the folded sheets in lieu of stabbing. It is a very cheap and expeditious mode

of fastening sheets or leaves together, and is done by a simple but effective little press which pushes the ends of the staples through the paper and turns them in and clamps them all at one operation.

Eyeletting.—Luggage labels and some other kinds of work require eyelets. The necessary hole is punched in each label by a die affixed to the plunger of the machine, and when the eyelets, which are little rings of metal, are to be affixed, the dies are changed, the lower one being furnished



STAPLER.



EYELETTING MACHINE.

with a compressible pin. On this are placed the eyelet and label, and on the lever being pulled the plunger descends and clamps the eyelet into the label, rounding off its edge. Machines are now made which punch the hole, supply the eyelet, and clamp it automatically.

Packing.—Work finished is wrapped up in parcels, each bearing, legibly written upon it, a statement of its contents. If it is to be kept in the establishment, it should be removed to a suitable, clean, and accessible place, where it can be obtained when required with the least amount of trouble.

BOOK V.

THE FOUNDRY AND ANCILLARY DEPARTMENTS.

CHAPTER XCI.

Stereotyping.—Definition—Advantages—the Paper Process—Materials and Apparatus — Manipulation—Preparing the Paste—Making the Flong—Stereotype Metal—Making the Mould—Casting—Finishing the Plate—The Plaster Process.

Stereotype is a word compounded from two Greek words—*stereos* solid, and *tupos* impress—and conveys the idea of printing from a forme consisting of one or more plates of type metal instead of from movable types.

The process is briefly this: From a relief surface, such as type or woodcuts, or both combined, is taken by pressure a mould or an impression in intaglio. Molten metal being poured upon this mould, a cast is obtained, the surface of which is in relief, and precisely identical with that of the original.

The *advantages* of stereotyping are several. From this one mould may be made an indefinite number of plates or casts, each of which may be printed from with very nearly as much perfection as from the original type. If a tract or handbill is required to be printed, it may be set up and casts taken. Two, four, eight, or any convenient number of these can be laid down on the press and printed from simultaneously, thereby increasing production in the proportion of the number of casts. The enormous number of copies printed of the morning newspapers is rendered possible only by the multiplication of casts by stereotyping, and by printing them simultaneously on several machines.

Stereotyping avoids much of the wear of type, as the

original forme need not be printed from, and the type after the mould is taken can be returned to the cases almost in the same condition as it was before, however large the number of copies required of the job.

It releases and renders available for fresh work large quantities of type. If a reprint of a book will be wanted the type need not be kept; plates may be made and put aside, and printed from whenever occasion requires it; or moulds only of the pages may be taken and stored.

In any such reprinted editions there can be no possible variation from the first edition. Indeed, stereotyping was originally proposed on account of the facilities it afforded for the production of new editions of books, such as the Holy Scriptures and the classic authors, which are reproduced frequently, and without alterations in the phraseology. It was seen that not only would the expense be saved of resetting the type each time an edition was wanted, and the expense of keeping type locked up avoided, but absolute correctness would be ensured, if correctness were attained in the original edition, as the stereotype process would effectually obviate any alteration.

Stereotyping greatly increases the resources of an office. No large printing office now dispenses with stereotyping, and we think that few small offices can afford to do without it. It is in the latter class of offices, indeed, that its advantages are most obvious. Where the stock of type is small, such a method of saving it from wear and tear is most important. It does away with the necessity of keeping many standing formes, and increases the productiveness of a limited stock of machinery or presses. Part of a work may be set up and stereotyped, and the type is ready to be used again.

If a forme consisting of woodcuts and type be damaged during working off, the composition and the wood engraving might have to be done afresh. If only a stereo plate be

worked from, and the mould has been kept, all that is necessary is to make another cast.

Plates are, obviously, more easily and economically stored than type formes. They take up less space and are more safely and conveniently manipulated. Paper moulds may be sent long distances at the minimum of expense, and afterwards cast from.

The moulds from which stereo plates are made by the paper process are flexible, and can be bent to any curve. From these, curved plates may be cast, which can be fixed on the cylinders of rotary machines. In this way a difficulty was obviated which had long stood in the way of the adoption of the rotary principle of printing, though now plates are sometimes cast flat and afterwards bent to any curve desired by suitable machinery.

If, instead of type metal, a substance like indiarubber is used for the cast, we get flexible stereos which will print on unyielding or irregular surfaces. Rubber stamps for office purposes are well known.

In newspaper printing, where an alteration, such as a late item of news, is required after the paper has gone to press, if type be used the machine must be stopped while the alteration is being made. But when casts are used the printing can go on with only the momentary interruption necessary for putting on the fresh plate.

The art is simple and the apparatus comparatively inexpensive, and a small foundry, with all necessary utensils, may be purchased for considerably less than twenty pounds. The following instructions will have reference to such an outfit:—

The two essential points of stereotyping are, making—1st, the mould or matrix; 2nd, the plate or cast.

There are now two materials from which the mould is usually formed, *viz.*, plaster of Paris and paper; and these divide stereotyping into "the plaster process" and "the

paper process." The system of forming a plate by deposition in an electric battery is also a kind of stereotype, but as it is known as electrotyping, and practised as a separate art, we defer its consideration until stereotyping has been disposed of. The cast is made of metal, the composition of which will be subsequently referred to.

The Paper Process is unquestionably the simplest of the processes as well as that generally employed, so we will begin with it.

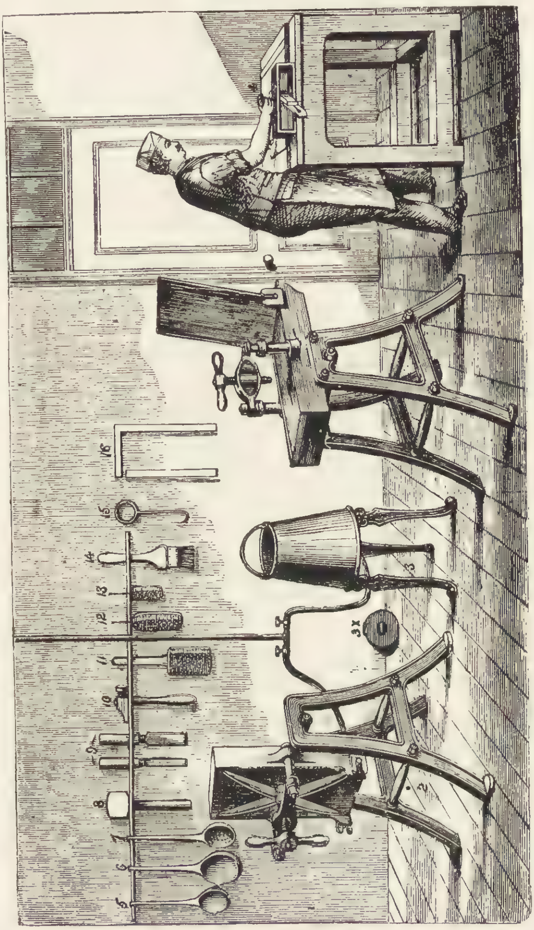
Materials Required.—The following is a list of materials required for casting plates up to royal folio. For larger sizes several more elaborate utensils are desirable.

The Melting Furnace.—(No. 3 in engraving.) The use of this is to melt the metal required to form the cast. Any stout iron pot, with a flange to rest on the furnace, will do for a melting pot. The fumes from type-metal are somewhat prejudicial to health, and should therefore whenever possible be carried away by means of a flue or chimney.

The makers of the portable stereotyping foundries have introduced for this purpose specially contrived gas furnaces, which are exceedingly convenient. They are heated by an "atmospheric" burner attached to a piece of flexible india-rubber tubing, which is connected with the gas pipe. They are thus easily put aside when not wanted, and the heat is quickly got up when necessary without the dirt and trouble of coals. Another advantage is that the insurance companies do not levy any increased rate on account of these appliances. The furnace is double, one part holding the metal and forming the pot or crucible, and the other forming a hot-air chamber when the gas-jet inside it is ignited. The pot is provided with a movable lid (3 x) to keep out dirt and dust when not in use.

The Drying and Casting Box.—This apparatus (No. 2 in the engraving) is the most important feature of the paper process. The mould is formed of a composite kind of

damp paper (*papier mâché*), and requires to be dried before it can be cast from. The box has a flat, planed iron surface



PORTABLE STEREO FOUNDRY.

or bed. Attached to one end by hinges is a planed lid, which is raised and lowered like the tympan of a printing

press. At two sides of the bed are two upright pillars, and between them a movable plate into which a screw works, being actuated by two handles. When these handles are turned the screw descends, like that of a copying press, and exerts any required pressure upon whatever may be below. In short, this screw, together with the lid of the box, will squeeze, on the platen principle, any forme laid on the bed underneath. The screw piece, or head of the press, is made to move laterally, so as to be out of the way of the lid when turned down or raised up. Underneath the box there is a gas burner to heat it, this burner being connected by a flexible pipe with the ordinary gas supply of the apartment.

The bed of the box stands on four iron supports, but it is attached to them only on an axle, and can be changed from the vertical to a horizontal position. A pin, fixed in one side of the stand, keeps the table in a horizontal position when necessary. The object of setting it upright is to pour down into it the molten metal when casting.

Ladles.—(See Nos. 5 and 6 in the engraving.) These are of the ordinary kind used by founders. Two of them will, at least, be required, one having a bowl four inches, and one about two inches in diameter. They are used for transferring the molten metal from the melting-pot to the casting-box.

The Skimmer (No. 7 in the engraving) is a ladle with a perforated bowl. It is used for removing impurities or foreign matter from the melting-pot while the metal is being melted.

The Mallet.—(No. 8 in the engraving.) Shaped like an ordinary carpenter's mallet, and with a squarer head than that used by the printer.

Chisels.—(No. 9 in the engraving.) Two of these are required, one being a half-inch broad, and one an inch broad. They are used with the mallet, for trimming the plates.

The Hammer.—(No. 10 in the engraving.) This calls for no special remark.

Beating Brush.—(No. 11 in the engraving.) A strong hair brush with a handle, used for beating the paper pulp into the interstices of the type. It should be about five inches long and two and a half broad, and have a handle about seven or eight inches in length.

Oil Brush.—(No. 12 in the engraving.) A small brush used for oiling the face of the forme previous to taking the mould, and for preventing the paper adhering to the forme.

Chalk Brush.—(No. 13 in the engraving.) For removing the superfluous chalk from the surface of the paper mould.

Paste Brush.—(No. 14 in the engraving.) For pasting together the sheets of paper which are to form the mould.

Casting Gauges.—(No. 16 in the engraving.) They serve to regulate the thickness or height of the plate by keeping the lid and the table of the casting-box at the proper distance apart. There may be two sets, one for the ordinary (pica) thickness of stereo plates, and the other for type-high casts.

Plane and Shooting Board.—(No. 4 in the engraving.) This is used for planing the backs of the plates, and for bevelling their edges if necessary. It should be set up on a strong bench. A circular saw arranged in the side of the latter is a very useful addition.

A Hook, for lifting the lid of the melting-pot (No. 15 in the engraving).

These are all the special apparatus that are required; but several materials and appliances generally found in a printing-office must be brought into use. For instance, a small imposing surface must be arranged so as to stand near to the casting-press and the melting-pot.

The Flong.—The plates are cast from a *papier mâché* matrix, called by the French, to whom we are indebted for the paper process, *flanc*, which when properly pronounced

sounds something like "flong," and has given this word to our technical language.

This flong is formed by uniting several sheets of paper by means of a special paste or stereo composition for which the following is a useful recipe; but there are many different ones preferred by various stereotypers:—

To make Stereo Paste or Composition.—Take 1 lb. good wheaten flour, 9 oz. white starch, 1 dessert spoonful of powdered alum. Mix up smoothly with a sufficient quantity of cold water for the purpose, and boil it in the usual manner for making bookbinders' paste. When it is required for use, mix intimately with it an almost equal quantity of pulverised whiting.

The mode of using this composition is to take $1\frac{1}{2}$ lb. of it, add 1 lb. of whiting and one pint of hot water. This mixture, when cold, should appear in substance like very thin bookbinders' paste.

After the paste is made it ought to be passed through a fine sieve to prevent the possibility of there being any lumps in it.

Another recipe is 2 lb. flour, 1 lb. whiting, $\frac{1}{2}$ lb. glue, adding a small piece of alum to prevent fermentation. Mix with water to the consistency of thin paste.

Prepared paste or "stereotype composition" may be had in tins, ready for use, from the printers' brokers.

To make the Flong.—Lay down upon a smooth iron or stone surface a piece of stout brown paper. Paste the surface of this over equally with the paste already mentioned. Lay a sheet of good blotting paper upon the pasted surface, and press it down with the hand. Paste this over, and then put another sheet of blotting paper on; smooth well, paste this over; then place a sheet of good tissue paper or copying paper upon the blotting paper. Press it well down again, paste over again, lay another sheet of tissue on the last, and smooth the whole carefully. Some stereotypers pass

a small steel roller over the flong to better incorporate it together, remove any possible crease, and give it greater firmness.

The careless pasting of the blotting and tissue papers is a fruitful cause of failure in stereotyping. Great care should be taken with this preliminary operation, as bad flong will endanger the success of all that follows. Flong can be bought ready made.

Preparing for Casting.—Having the flong ready, we may prepare for casting. If one of the portable foundries, such as is before referred to, be used, the gas jet under the drying and casting box should be lighted. The lid should be put down so that it may be warmed to an equal temperature with the rest of the box. This is necessary in order that the mould may be properly dried.

The gas burner in the furnace or melting-pot should also be lighted. In using the small gas furnace, when lighting the gas in the furnace, the tap should in all cases be turned full on, and the light applied inside, from the top, by lifting out the metal pot. Should the light be applied too soon after turning on, or should there be an insufficiency of pressure, the gas is liable to ignite at the bottom of the burner where the gas and atmosphere enter it, in which case it must be extinguished or the metal will not become fusible, the metal pot will become covered with a thick coating of gas black, and a suffocating smell will arise from the gas. If lighted properly the flame will be of a bluish colour, and the heat will be so intense that 100 lb. of metal will be ready for use in half an hour.

Stereo Metal.—Take 6 lb. of lead and 1 lb. of antimony. Some stereotypers prefer to use 12 per cent. of antimony in a given quantity of lead. The antimony is a white metal, and so brittle as to be easily pulverised. When heated to redness it melts; at a higher heat it evaporates. It should be broken into very small pieces, and thrown on the top of

the lead when it is at a red heat. Stereo metal ready prepared may be had from the printers' brokers.

The simplest mode of making stereotype metal is to melt old type, and to every 14 lb. add about 6 lb. of grocer's tea-chest lead. To prevent any smoke arising from the melting of tea-chest lead, it is necessary to melt it over an ordinary fireplace for the purpose of cleansing it, which can be done by throwing in a small piece of tallow about the size of a nut. Then stir it briskly with the ladle, when the impurities will rise to the surface and can be skimmed off.

Care must be taken in the mixing of lead and type-metal that there are no pieces of zinc in it. The least portion of zinc will spoil the whole of the other metal that is mixed with it.

Zinc is of a bluish-white colour; its hue is intermediate between those of lead and tin. It takes about 80 degrees more heat than lead does to bring it into fusion. Should any metal float on the top of the lead, do not try to mix it, but immediately take it off with the ladle.

Another test of zinc in the type-metal is obtained by plunging a red-hot poker into the metal when it is at the heat that it would scorch a piece of paper black. If the metal does not adhere to the poker, it is free from zinc; if, on the contrary, metallic patches appear on it, zinc is present.

Preparing the Forme.—Having compounded the flong for taking the mould, and got the metal hot and ready for making the cast, the next thing to be done is to prepare the forme.

Place the forme on the imposing surface and unlock it. It must be prepared for moulding from by being surrounded on all sides with metal furniture or clumps, type high, bevelled on the inner side, and generally three long primers thick. The object of surrounding the page with clumps or stereo furniture of this particular width is to form a guide

for laying the casting gauges when the mould is placed in the casting box.

If you have a small stock of metal clumps in lengths—which may be had from the printers' brokers—cut four pieces, sufficient in length to go entirely round the forme, and enclose it as in a border. This border is bevelled or "chamfered" on one of the top sides, and the bevelled portion should be against the forme, so as to leave about a nonpareil of "white" or open space between the face of the clump and that of the type.

If you have not a supply of this furniture, it is easy to make one. With most of the portable apparatus are sent out type-high gauges, which may be adjusted to the proper thickness, and the furniture cast with them as directed in the following paragraphs in the case of type plates. Of course you will not use any mould.

If the forme to be cast consists of eight or more pages, a little extra care must be taken in preparing it. Take out the furniture in the margins, and in its place insert a piece of *double bevelled* type-high clump between the pages. There will thus be a distinct break between each page, consisting of two channels or whites, caused by the double bevel of the clumps. In this way you will not only get a guide for the true and square dressing up of the plates, but an opportunity for separating those of the respective pages by merely knocking them, at the point where they are intended to be separated, against the edge of the imposing surface.

The side and foot sticks are, of course, placed *outside* the stereo clumps. Next tighten the forme a little with the finger. See that it is perfectly clean, that there are no spaces standing up, no leads or rules riding, and that the quads, etc., are all even and secure. If the forme is perfect, lock it up in the usual way, taking great care not to bow or bend it.

Ascertain next that the forme will lift with safety, that no quads or letters "dance" or become loose. Then slacken

the quoins, so that they are not too tight to be moved with the fingers, and very carefully plane down.

Next, *oil the forme*. This is done with the brush provided for the purpose. A little oil may be poured into the palm of the left hand, and the brush rubbed evenly into it. Apply the brush and the oil it contains lightly but thoroughly to the entire face of the forme. Either sperm oil or olive oil may be used; the latter is preferable.

Again lock up the forme tightly, and in such a way that it is perfectly square and level on the face, and has no leads, spaces, letters, or quads out of their places.

Making the Mould.—Cut a piece of flong and two pieces of soft but stout wrapping paper a little larger than the forme, including the type-high furniture. Immerse this piece of flong in hot water, in a similar manner to that for damping paper for printing. Do this three or four times, and each time place it immediately face downwards on a sheet of blotting paper to absorb the superfluous water. Whilst in this position, paste the two pieces of wrapper with ordinary bookbinder's paste, as evenly as possible, and lay them aside. For open work it is well to mix an equal proportion of whiting to that of paste. It will facilitate the drying and give body to the matrix.

Now, keeping the forme on the imposing surface, place the flong on it with the tissue paper side next the type. Over it spread a piece of damp linen, and with the beating brush begin to beat the flong into the type. Take care to beat lightly on those parts of the forme which are open. Continue beating until the paper has well penetrated the forme, and sufficiently to give the required depth to the cast. This is a matter of experience and practice, but the knowledge when to leave off is soon acquired. The principle of good beating is to apply the brush so that its whole surface touches the forme each time; this secures *even* beating, without which the operation would not be successful.

Next add one of the pieces of wrapper, already pasted, and beat it into the flong, having removed the piece of damp linen. Great care must be taken to effect a perfect union of the flong and the wrapper, and to exclude any air bubbles that may have got in between them. An occasional plane down, the planer being held very firmly, is of great advantage.

Next lay the *second* wrapper, already pasted, on the back of that just finished. Again beat, somewhat lightly, and use similar precautions against the entrance of the air. The moulding is now finished.

The whole process of making the mould should not occupy more than five or ten minutes.

Some stereotypers vary the process already described, but in minor details only. After the flong has been applied to the forme, they exert a gentle pressure on it, by giving a slight pull at a printer's or a bookbinder's press; and the larger sets of stereo apparatus comprise a special press contrived for this purpose. The object of this pressure is to fix the mould in its place. The precaution must be taken of laying a sheet of paper upon the back of the mould to prevent it from adhering to the platen of the press.

Instead of the damp linen previously spoken of, a piece of stout calico may be taken and soaked in water. The superfluous moisture should be wrung out, and the calico, doubled, laid on the back of the mould.

Any large stiff-haired brush will do for beating, if it has a long handle and a perfectly even surface. The beating over the fabric which covers the mould should be regularly and evenly done. The face of the brush must be brought down perfectly flat—this is the most important part of the operation.

To ascertain if the impression is sufficiently deep, one corner of the mould may be carefully lifted from the forme. If the required depth has not been reached, replace the mould gently, and beat a little longer.

If there are extensive depressions in the forme, as in title pages, labels, and forms, a few fragments of an old mould may be cut out and pasted on such spots before affixing the sheet of brown wrapping paper.

Drying the Mould.—As already stated, we are now describing the use of the portable stereo foundries. All that is necessary, therefore, is to show how the drying can be done without the aid of a furnace, such as is used in large stereotyping establishments.

Lift up the lid of the drying and casting box, and place the forme, with the mould on the centre of the surface, between the two upright pillars. Spread a piece of thick machine blanket over the whole, and immediately cover the whole with the lid, and screw it tightly down with the lever, say a little more than can be done with one hand. Then turn on the gas. Let the mould remain in the press about ten minutes, then raise the lid, which will allow the confined steam to evaporate, and let the lid remain so about two minutes to allow the matrix to dry thoroughly. Then remove the forme back to the imposing surface, and take off the mould.

Trimming the Mould.—It will be found that the metal furniture round the forme has left its impression, which looks like a frame round the type. The removal of the superfluous flong beyond this is called "trimming the mould."

Trim the mould with a pair of shears, within an inch of the outside of the impression of the furniture. The latter is to serve as a resting-place for the casting gauge. Should any projection appear at the point where the metal is joined at the corners, etc., be particular to hammer it down quite flat. Paste a piece of stout brown paper on one edge of the mould. It should be of the same width as the mould and about four inches in depth, allowing it to project out of the casting box when the mould is fixed ready to receive the liquid metal.

When this is dry, dust the face of the mould well with powdered French chalk, applied by means of a soft brush. Then remove the superfluous chalk with the chalk brush. If you have not a chalk brush, turn the matrix face downwards and strike the back smartly with a cane, to cause the superfluous chalk to leave it. The mould is now ready for casting from.

Casting the Plate.—Place the mould on the bed of the drying and casting box, face upwards, and as near the centre of the two uprights as possible. Lay the pica gauges on the margin of the mould. Place another sheet of thoroughly dry smooth brown paper on the mould, to project the same distance as the one pasted on the matrix.

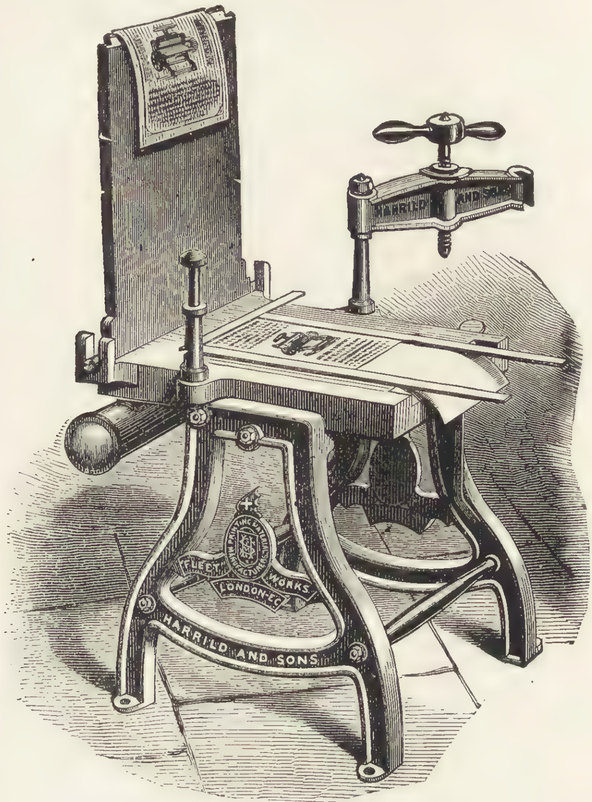
The paper that was pasted to the mould will be found to protrude several inches from the mouth of the drying and casting press. The paper last mentioned should also project to a similar extent. (See illustration, p. 249.)

Put down the lid of the casting press, and screw it down tightly by means of the weighted handle at the top. Take out the small pin attached to the side of the iron framework, and very gently alter the position of the press from the horizontal to the upright. It is now ready for pouring the metal on to the matrix.

The metal must be poured between the two projecting sheets of paper.

Previous to pouring the metal into the casting press, its heat should be tested. Fold a piece of writing paper and insert it in the metal. Should the paper quickly turn a lemon colour it is ready for pouring. If it makes the paper black, the metal is too hot. The mould being paper, cannot sustain an intense heat. In all cases carefully remove the scum from the surface of the metal pot, in order to take into the ladle bright metal only. Take care that all the metal is perfectly dry before you put it in the pot. You may drop a piece of Russian or other tallow into the pot,

in order to flux the metal, and skim off the impurities and dross, which arise to the surface, with a perforated skimmer. Warm the ladle before putting it into the metal.



CASTING BOX, MOULD AND GAUGES.

Pour the metal gently and steadily into the casting press until it is full or nearly so. After a brief interval restore the press to its former horizontal position and fix it with the pin as it was before.

Now unscrew the lid, and the cast will be seen. Turn

CASTING THE PLATE.

the cast over on its back, and raise the mould gently by working the forefinger of each hand gently along under-

neath the edge of the mould, being careful not to put too much strain on any particular part.

Sometimes, especially if there has been any paste or dirt on the face of the mould, it will not come off the plate. Plunging both into cold water may save the plate, but it will destroy the mould.

Trimming the Plate.—After the plate is cast, it must be trimmed. The superfluous metal, called the "pour," must be taken off with a saw. The edges must be bevelled with the proper plane, and the back planed with another plane. If the forme is one of eight pages, it should be separated from the superfluous "pour" with a saw or a mallet and chisel, and planed evenly all round, leaving about a pica margin from the matter for bevelling the edges, if required.

When the plates are cast type high they are "cored" by placing a core or thick metal plate in the box above the matrix.

A scarifier and engraver are necessary to remove any superfluous metal adhering to the plates. They are then to be pulled, and the imperfections carefully noted. The proof is sent with the plates to the "pickers," who remedy those defects that are marked.

General Hints.—The imposing surface on which the forme will be laid while the mould is being beaten into it, should be firmly fixed up, so as to prevent any vibration during the beating.

Where a number of plates are wanted, a saw and planing bench is almost indispensable. It should include a circular saw—6 in. diameter is a useful size—an imposing surface, and a plane and shooting bench. It should have a movable gauge or guide. The best article of the kind will have a steel spindle running on steel centres for the saw, and a band and treadle to actuate it. The top should be capable of being lifted off while the saw is being adjusted. The plane should be fixed at the right-hand side, and have a

receptacle underneath for catching the shavings of metal. The circular saw should be placed at the left side. Underneath the surface a couple of strong drawers may be fitted up.

All stereo casts differ in size from their originals on account of the shrinkage due to cooling. A page of type twelve inches deep would be reduced in the cast at least a nonpareil, probably three thick leads, and proportionately in width. This cannot be obviated, but allowance must be made for shrinkage when small pieces have to be composed as alterations or corrections in plates and cast for insertion by the pickers.

The preceding directions will, it is hoped, enable any one to cast an ordinary plate in one of the portable foundries which are now so much in use. They also exemplify the general principle of the process, and are, as far as they go, applicable to the large foundries employed in extensive stereotyping establishments. A short account of the latter may, however, be of service.

Large Stereo Foundries.—The stereotype furnace is about two feet square. It is in shape like an ordinary household washing copper, the melting pot occupying the place of the copper. The front is of iron, and provided with a small door, through which the coals are supplied. Bars underneath and a small hearth allow of the removal of the cinders.

Extending about twelve feet laterally from the furnace, and on a level with its top, is the iron "surface." It is hollow, and forms part of the flue of the furnace. It is supported by one or more piers of brick.

At the extremity farthest from the furnace, there is a screw press.

The forme is dried by being placed on this surface, and various degrees of heat can be applied according as the forme is placed nearer to or more distant from the furnace end,

After moulding, the forme and matrix are placed under the press for awhile, then allowed to dry on a warmer part, with a metal plate on to keep the mould down, while another forme is placed under the press, and so on.

The casting press is called a "casting register." It is placed on an axle on an upright stand. The construction is similar to that already described.

A complete foundry for general work consists of the furnace—with surface, press, drying chamber, flange and metal pot; the casting register; the moulding table and iron roller; the planing slab and planes; and the planing machine.

The Cold Paper Process.—In the method above outlined, the matrix is kept on the type while it is being hardened by drying by heat. It has been found that the necessary heat slightly elongates the type, and tends to render it useless, owing to its disparity in height, when returned to the case, as compared with type which has not been subjected to the process. To avoid this and other disadvantages, a method has come into use wherein the matrix is dried separately, being removed when moist from the forme, as soon as the impression is obtained. It is then placed on a bed of sand heated by gas. In this way the forme is never heated; and the wear and tear of the type is not only greatly lessened, but there is a saving of time in making the plate, as the period for drying the matrix is reduced from 7 minutes to 2 minutes—no inconsiderable advantage in a newspaper office. The process has been in one respect further modified, as follows: The mould, being taken from the forme in its moist state, is without loss of time laid on a framework of wire gauze within an iron frame, so constructed as to secure rapid evaporation of all moisture. A few thicknesses of flannel are then laid on the mould, and upon the flannel is placed an iron frame interlaced with wire, and of sufficient weight to prevent "buckling." This is prevented by leverage from pressing on the mould unduly until a certain amount

of moisture has been driven off. The rest of the drying is done in the sand bath heated by gas.

The Plaster Process.—The apparatus required for casting by the plaster process is the following:—

An oven with metal pot and flange; a crane; dipping pans; moulding slabs; frames for moulding slabs; planing slabs and two planes; finishing lathe. The pages of type [1] are first of all imposed in the composing room with high stereotype furniture. They are then sent to the founder, and go in the first instance to the "moulder."

The following is a slight outline of the plaster process:—

The moulder places the forme upon the moulding stone, and rubs the face with fine olive or sperm oil, in order to prevent the adhesion of the plaster mould. Around the forme, and fitting to it closely, is placed a metal framework, about three-quarters of an inch in depth, called a "flask," and into this plaster of Paris, in a semi-liquid state from the admixture of water, is poured.

While the mixture is still soft it is well rolled or spread evenly over the surface of the type, or scraped with a piece of brass rule, for the double purpose of giving a uniform thickness to the mould, and also of expelling, as far as practicable, the minute air bubbles, which, if not driven from the mould, would cause picks or small imperfections on the surface of the stereotype cast.

In a few minutes the plaster hardens into a compact mass, and the mould is placed in the oven to be baked, and may then be lifted from the type. It is now trimmed.

The mould, with others, if necessary, is next placed with

[1] Formerly matter for stereotyping by the plaster process was always set up with high spaces and quadrats, which prevented the penetration of the plaster to any considerable depth, the object being to prevent the "clogging," which had to be broken off when the type was distributed. Professional stereotypers by this method do not now require the use of specially high spaces.

the face downward on the "floater," a plate of metal fitting on the inside of the "dipping pan." This is a large shallow cast-iron dish or box. At the top is a kind of arch, the middle of which has a screw thread, by whose means, and the screw, the lid can be brought down firmly on the back of the moulds. The entire apparatus is connected with a crane, by means of which it is steadily lowered into the casting kettle or pan containing the molten lead, which usually consists of 6 lb. of lead to 1 lb. of antimony.

The metal rapidly runs into the open corners and sides of the pan, filling up every hollow space and the minutest interstice in the plaster mould.

After about ten minutes have elapsed, the pan must be raised by the winch, and cooled off upon the wet cooling trough. The stereo cast is then knocked out, and sent to the finishing room for examination and approval. The backs are turned in a lathe to obtain perfect and regular thickness. They are side-planed, chiselled, and thoroughly gone over for picks or other imperfections, which the most careful casting will not always prevent. Finally the plates are put in boxes containing each from sixteen to ninety-six plates, according to their size, and delivered ready for the printer's use.

Comparative Advantages and Disadvantages of the Paper and Plaster Methods:—

(*a*) The paper process is by far the most rapid, which is of great importance in newspaper and hurried work.

(*b*) By the paper process a series of plates may be cast from one matrix: in the plaster process, on the contrary, the matrix is destroyed when casting a plate, by releasing the shell or cast. Hence the paper process is the most useful when a number of casts are required from a job to be worked together on the machine.

(*c*) The paper matrices may be preserved for future use, and can be packed and sent any distance at any time.

(*d*) The paper process is the simplest, and can be practised, as we have seen, on a very small scale.

(*e*) The plaster process, on the other hand, has the advantage over the paper process of giving deeper and sharper casts, thus rendering it preferable for stereotyping formes of small-bodied types or woodcuts; but electrotyping has now nearly superseded both methods for this purpose. The plaster process is also preferable to the paper process for producing plates from formes of music types, as the plaster mould contracts somewhat in drying, and thus causes the divisions in the "stave" lines to show very little if any opening whatever. Some Bible printers also use it because they believe it gives a more solid cast, and one which works "darker" and more evenly.

CHAPTER XCII.

ELECTROTYPING.—Nature of the Process—Its Advantages—Preparing the Forme—Blackleading the Forme—the Moulding Tray—Pouring the Wax—the Moulding Press—Delivering the Mould—Building—the Building Knife—Blackleading the Mould—the Battery—the Bath, Vat, or Depositing Trough—Getting the Deposit—Backing the Shell—Finishing the Plate—Steel, Brass, and Nickel Facing.

ELECTROTYPING is a process for separating metals from solutions of their salts and depositing them in solid form by means of the electric current excited by a battery or dynamo machine. In this way we can produce plates or blocks from which impressions can be taken by the methods usually employed in letterpress printing. Electrotyping, in fact, accomplishes in a superior manner nearly all the ends attained by the stereotype processes, and is to printers one of the most useful, interesting, and important of all modern discoveries.

Electrotyping versus Stereotyping.—Electrotyping has superseded stereotyping in reproducing wood engravings, as it produces better copies—copies, in fact, which are quite equal to the original block for working from. For obtaining plates of type-matter it is also better than either of the processes of stereotyping, for hundreds of thousands of impressions may be taken without materially reducing the sharpness of an electro, while an ordinary stereo would be almost worn out by printing a much smaller number. This, of course, arises from the superior hardness and toughness

of copper, of which the surface of the electro is formed, over type-metal, of which the stereo is formed.

It costs less to stereotype a given surface than to electrotype it, and the operation can be performed, especially by the *papier mâché* process, in a shorter time than electrotyping; so that, where speed or cheapness of first cost is a paramount consideration, stereotyping is to be preferred to electrotyping; but in all other cases, when duplicate copies of a forme are required, it is advantageous to electrotype them.

The Process of Electrotyping.—The process is divided into seven parts: (1) moulding the forme; (2) building up and trimming the mould; (3) preparing the mould for the trough; (4) immersing the mould in the trough; (5) releasing the shell; (6) backing the shell; (7) finishing the plate.

Preparation for Electrotyping.—The forme should be imposed in a small chase, accurately justified, tightly locked up, and well protected on all sides by high clumps or type-high bearers. The bevelled clumps used for stereotyping are employed in exactly the same way for this method.

To prepare a woodcut for moulding, lock it up in a chase with a type-high bevelled clump border all round it. Brush the cut over sparingly with turpentine, to remove the printing ink which remains on the block after the taking of the proof. Should the cut be an old one, and the fine lines much clogged with ink which the turpentine fails to remove, it is better to brush the cut with a hard toothbrush, dipped in spirits of salts.

The object of the type-high clumps, in this instance, is to prevent the wax of the mould from spreading; and the facsimile of them, forming an outside border to the shell, becomes a barrier to the metal, retarding it from getting to the face of the shell during the process of backing. It also forms a wall for the dogs of the lathe to bite firmly while the back of the plate is being planed.

It is necessary to ascertain whether the woodcut is the same height as the clumps, and this is done by taking a straight-edge or a piece of column-rule, and laying it on the forme. If the latter is not the same height as the clumps, it must be underlaid; indeed, the block should stand a little higher than the clumps. In a forme of type there will, of course, be no necessity to test the height with a straight-edge. Let the forme or cut remain until it is perfectly dry.

Blackleading the Forme.—The first process of the electrotyper, after seeing that the forme is clean and level, is to cover it with finely powdered blacklead or plumbago, and subsequently to remove all excess of blacklead by rubbing the palm of the hand over the surface of the type or woodcut. This is done in the blackleading tray, and the blacklead may be applied with a brush, taking care that it is well bronzed over, and, if an engraving, that no particles of the lead are left in any of the fine lines of the engraving. The blacklead must be free from all adulteration.

The Moulding Tray should be of the same shape, as far as possible, as the forme to be electrotyped. It may be of stereotype metal or of brass. In appearance it resembles a shallow printer's galley, but surrounded on all four sides; it is about a pica or an english in depth. Two pieces of stout copper wire are soldered on to one edge in such a manner that the mould may be suspended by hooks in the depositing trough.

Pouring the Wax.—The moulding composition is made by mixing 10 lb. of beeswax with $1\frac{1}{2}$ lb. of Venice turpentine and 4 oz. of blacklead. A slight variation in the quantities may be adopted by different firms, but one essential rules everywhere: that the ingredients should be of the best.

Warm the moulding tray a little, lay it on a flat table perfectly level, and with a tin ladle pour the wax into the tray in a continuous stream, with a slow, steady, rotary motion, within an inch or so of the sides of the moulding tray.

Let the wax set all over, and then brush over the surface with plenty of blacklead, laying it on with a soft hat brush. The sooner the blacklead is applied to the surface of the wax, without distrubing the wax or marking the surface with the hairs of the brush, the better will be the mould, as more blacklead will be held on the surface.

Moulding.—The forme or woodcut must be moulded while the wax is yet warm, but it must be perfectly set. The temperature of the room in which this important process is performed must be maintained at about summer heat (60°).

The Moulding Press may be a copying press (which is suitable for small jobs), a nipping press, or a hydraulic press.[1] The higher the temperature at which the wax is moulded, the less the pressure required. Place the forme exactly under the centre of the platen, with the moulding tray containing the slightly warm wax upon it, the wax of course being next the type or cut. The amount of pressure requisite to impress the wax must be learnt by practice; no directions can be given on this point.

Too shallow an impression causes a deal of work subsequently for the "building knife." On the other hand, an unnecessary depth of dip may result in damage to the mould in delivery.

Several kinds of presses are in use by electrotypers. They generally have lifting heads, with a weight at the end to compensate for power in raising them. When the head is down, a movable cross-piece is fixed to two small

[1] Professional electrotypers use a press capable of a pressure of 40 to 70 tons. This gives a very flat mould. Woodcuts require more pressure than type formes. Great improvements have of late been made in moulding presses, especially by the adoption of the hydraulic principle, by which a boy can obtain by hand about 10 tons pressure, whereas formerly, four men, with a screw-press, could together obtain only about 3 tons.

uprights, and this is worked upon by a connection with a wheel and pinion, which causes the impression. The apparatus is extremely simple.

Delivering the Mould.—To separate the mould from the forme a pair of "lifters" is required, although a thin screw-driver may be used instead. Insert carefully the lifters between the furniture of the forme and the edge of the moulding tray, at the top and bottom of the page, and gently, with a steady hand, apply leverage gradually, until the mould is relieved from the forme or woodcut. Should the mould not be a good one, melt the wax and begin again. Never lift a mould from the sides of the forme, or damage will result to the raised parts of the mould, which are to form the counters in the plate.

Building.—The mould, if good, has next to go through the process of building, which consists in dropping heated wax upon such portions as should be deeply sunk in the finished electrotype plate, that is, the places where "whites" are to appear after printing.

The *Building Knife* is made of copper; it is half knife and half spoon. Some use a heated *Building Iron*, or piece of iron shaped something like a poker, of convenient length, with a sharp point, which is applied to a strip of dry wax until some of the wax adheres to it; this wax is dropped in a melted state upon the portions of the mould which are to be raised.

If a building knife is used, there should be close at hand a small cauldron of melted wax, and a gas jet, by which to warm the building knife. Draw the knife along the projections that are to be raised still higher, and the wax will follow. The object of this is that where paragraphs or open work occur, the parts of the electrotype can be lowered to obviate the necessity of chiselling the plates, as in stereotyping.

The building knife can also be heated by dipping it in

molten metal, and the building can be done by holding the hot knife in one hand and a stick of hard, dry wax in the other, feeding the building knife as you go along the spaces between the lines.

Great skill is displayed by some electrotypers in building. It requires a steady hand to drop the wax exactly where it is required, and to avoid dropping it upon any spot where it is not needed.

Blackleading the Mould.—The mould, having been finished and pronounced satisfactory, has to be blackleaded, in order to enable it to take in the bath the metal deposited by the electric current, for the copper will not deposit on unsurfaced wax. Very pure, fine, and lustrous blacklead should be employed for this purpose. It must be well brushed in, filling all the interstices of the mould. The entire surface of the mould must be effectually covered, to ensure a perfect deposit of the copper. The mould is placed in an air-tight box (or blacklead frame), and is acted upon by a very rapidly-vibrating brush which soon gives it a very high polish.

After the mould is blackleaded, every particle of superfluous blacklead must be removed. This may be done by blowing it with a pair of bellows having a broad nozzle, or by brushing it with a flat badger's hair brush.

If the mould be held in the light at a certain angle, the operator may discern whether even the finest lines are properly polished. If any line or letter appears dull, the blacklead is not sufficiently blown or brushed out of such parts.

Preparing the Blackleaded Mould.—The mould now requires a further preparation, by having the back of the moulding tray coated with wax, to prevent the copper from being deposited upon it, for the deposit will be made wherever there is a metallic or burnished surface. Paint the back and sides, and also the edges of the moulding tray, carefully

with the wax, but take care that there is a bright metal connection between the copper wires spoken of in referring to the moulding tray and the blackleaded surface. This is necessary to ensure the deposit of the copper on the blackleaded surface, and it may be obtained by slightly scraping the edges of the tray from the places where the wires are soldered to the blackleaded surface. This bright connection is very important.

The Battery and the Bath.—We must now describe the bath, or vat, and the battery with which it is connected, giving also a brief outline of the theory on which the practice of electrotyping rests.

It is found that when two dissimilar metals are immersed in acidulated water, and are made to touch, or are joined to one another by a wire, a chemical change sets up. Minute particles of the one become detached from it, and these create an electric current, which can be communicated by a metal wire to any object fit to receive it. Thus, if a strip of zinc and a strip of copper be partially immersed in a weak solution of sulphuric acid, and the two strips be connected at the top by a copper wire of any length, the zinc will gradually waste, and the energy set up will cause a current to flow along the wire to the copper strip. The liquid itself is slightly decomposed by the current, small bubbles of hydrogen appearing on the surface of the copper strip. The copper strip is called the *positive* pole (or + pole), and the zinc the *negative* pole (or − pole). This great discovery was made by Volta, and a vessel containing acidulated water and two strips of metal is called a *Voltaic cell*. Combinations of cells are called a *battery*.

There are many kinds of cells. One is known as Daniell's. It consists of a cylindrical, glazed earthenware pot, like a large wide jam-pot, and inside it is placed a cylindrical pot, equal in height, but less in diameter; this is made of porous porcelain, so that liquid put inside it can gradually find its

way to the outside. Between the two pots is placed a sheet of copper, bent so as to form a hollow cylinder or tube, and inside the inner pot is put a rod or bar of zinc, which has been placed in strong acid for a short time, and then had quicksilver (mercury) rubbed well into its surface. The mercury combines with the zinc, and the rod is then said to be "amalgamated." To use the cell, the space between the zinc rod and the inner pot is filled with water acidulated with sulphuric acid, and the spaces between the copper roll and the inner and outer pots are filled with water in which sulphate of copper has been dissolved. A wire is attached with a screw to the top of the zinc, and another wire is fastened by another screw to the top of the copper, and these wires are made to communicate with the object which is to receive the current.

Another form of cell is Smee's. This is the most generally useful cell for electrotypers. It consists of a plate of amalgamated zinc and a plate of silver (generally covered with a thin coating of platinum), each with a wire screwed on to the top of it, and these plates stand in a pot or trough containing acidulated water (about 1 pint of sulphuric acid to 20 of water). The silver may be quite thin, and it lasts a very long time.

A good Smee battery for an ordinary sized bath consists of twelve plates—six zinc and six silver—each about a foot square, placed upright and alternately, about half an inch apart, in a trough of oak made just large enough to hold them. This trough should be lined with lead or marine glue, and should contain enough of the acidulated water before mentioned to cover the plates. All the wires from the zinc plates are to be brought into communication with one wire or band of copper, and all the wires from the silver brought into communication with another wire or band of copper. Joining up in this way increases the volume of the current; it is the same as if we had one large cell with a

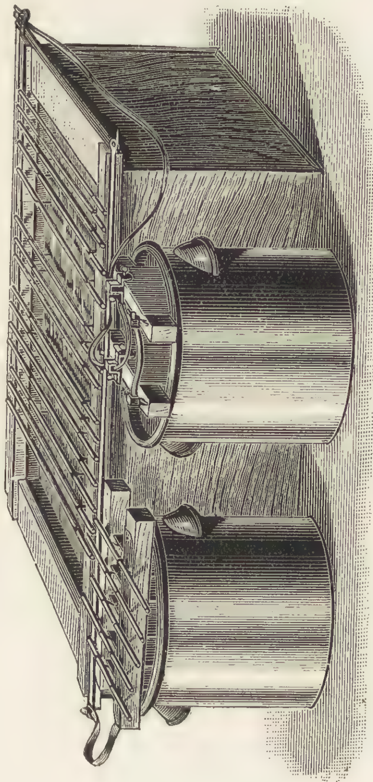
sheet of silver and a sheet of zinc in it, each having a superficial area of six square feet. If we want to increase the power, or electro-motive force, of the battery, we must join up cells in series, *i.e.*, the silver of the first to the zinc of the second, and so forth; this gives force in proportion to the number of cells, but the volume of the current remains as if there were but one cell with a sheet of silver and a sheet of zinc each a foot square.

The vat or bath, otherwise called the Depositing Trough, is a lidless box made of wood—preferably oak—lined with lead or marine glue, to make it water-tight. Across it are placed rods of brass tube on which to hang the moulds, and the pieces of sheet copper (called anodes), to be mentioned shortly, which assist in the work of depositing copper on the mould.

The bath is filled with a solution of sulphate of copper; that is, acidulated water in which a quantity of sulphate of copper (which is sold in the form of blue crystals) is dissolved. As the solution gets weak fresh sulphate of copper crushed to powder is added. A little fresh sulphuric acid is also occasionally added to the bath. A common mode of making the solution is to put a pound of the sulphate and a pound of sulphuric acid to a gallon of water, dissolving the sulphate first and adding the acid afterwards.

Getting the Deposit.—Having now described shortly the battery and the bath, let us recur to the mould. We had left it properly blackleaded and ready for the bath. It is now immersed in the sulphate of copper solution in the vat, and is suspended from one of the brass rods by a metal hook. On a brass rod parallel with it is hung the "anode," a piece of sheet copper about as large as the mould, and this is placed just opposite to the mould, and about three inches away from it. This done, the wires from the battery must be communicated (by screws) to the brass rods, the wire leading from the zinc plates to the rod on which the

mould is hung, and the wire leading from the silver plates to the rod on which the sheet of copper or "anode" is



BATH WITH CELLS ATTACHED.[1]

hung. The current caused by the battery will travel through the wire leading to the anode, will thence pass into the

[1] The bath shown is a large one, in which several moulds and anodes are hung from different rods at the same time. The cell on the right-hand side is providing the current; the similar vessel on the left-hand side is being used as a small bath for minor work.

solution in the bath, and will cross to the mould, and then go back again to the battery. In its course it will decompose some of the solution and a little of the anode, and the copper set free will deposit in minute quantities on the face of the mould. Let it be remembered that the mould must always communicate direct with the negative pole of the battery, and the anode with the positive pole.

The mould must now be left in the bath until the deposit is sufficient to enable you to judge if all is going on well, when it may be withdrawn for inspection. Should the copper deposit in places where it is not required, the spot must be dried, the place stopped out with wax, and the mould returned to the bath.

If air bubbles begin to form on the face of the mould, take it out of the bath, dip it in diluted methylated spirits, half spirits and half water, and then replace it.

The time usually occupied to deposit thick enough for ordinary purposes is from seven to twenty hours, according to the power of the battery.[1] This period can be much reduced by using increased battery power, as that of the dynamo machine, afterwards referred to. As our instructions are, however, merely elementary, we cannot describe in detail all the methods adopted by professional electrotypers. One result is that an electro, ready for printing from, is often now obtained within three hours; indeed, a shell can be got in 20 minutes. The general practice, however, is to place the mould in the trough in the evening, and take it out the following morning.

When the copper deposit, or, as it is technically called, the "shell," is of the proper thickness, it must be disengaged from the wax by placing the mould with its back on an inclined board; then pour boiling water over the

[1] Such a battery as we have described would do the work in seven hours.

shell, gradually lifting it at one corner. The boiling water melts the surface of the wax, and allows the shell to be released, not, however, without having a thin coating of wax over the face of it, which should be washed out with a mixture of turpentine and benzoline.

The removal of the wax may also be effected by placing the mould and the shell on a steam heating-table. The superfluous wax may be removed, too, with a heated solution of common potash.

Backing the Shell.—Get a small earthenware gallipot, and into this place some zinc cuttings. Take it into the open air, and pour on a quantity of hydrochloric acid (also called muriatic acid, or spirits of salt). The instant the acid comes in contact with the zinc, heat is generated, an offensive gas is given off, and ultimately a soldering fluid is formed, which must stand till it is cool. The back of the shell must be evenly wetted with this, with a brush. The next step is to tin and back the shell. Tin adheres readily to copper. Procure some good strip solder, fuse it, and pour from a ladle through a gauze strainer, letting it fall into water, which will cause it to become granulated or like irregularly shaped spots. Some of these must be sprinkled over the back of the shell after it is wetted with the soldering fluid.

Meanwhile, a quantity of type-metal must have been melting in an iron pot over a furnace. Put the shell in a pan, and with hooks [1] lower the pan gradually till it floats on the top of the molten type-metal in the pot. The heat will gradually extend itself to the shell and the solder, and when the solder is fused the shell will become tinned all over its back, and ready to receive the type-metal. Take some of this molten type-metal in a ladle, and from it (at

[1] In electrotyping establishments there is a crane with suitable tackle for lowering the pan.

the same temperature as the shell, if possible) pour over the shell, gradually and with a rotary motion, until the shell is covered and thick enough to enable the electrotype to undergo the operation of finishing. After remaining some time, draw up the pan, and let it cool as gradually as possible.

The metal for backing must be poor; say a hundred-weight of type-metal to an equal quantity of lead, and five pounds of bar tin.[1]

The iron pot referred to should be square, with a flange, and should be about three inches deep.

Finishing.—The plate, when cool, must be released from the backing pan, and washed on the face with turpentine or benzoline, and emery powder. It must be dried and polished by rubbing it in sawdust, and then, if perfectly even on the face, it is ready for the lathe. If there should be any depressions, however, they must be brought up by gentle taps from behind, the face of the electro being next to the flat surface of a metal table or slab.

The back now requires to be roughly planed. By means of the plane, also, the plate must be squared. Pass a straight-edge over it, make it perfectly level, and "chuck" it in the lathe. Plane the back perfectly true and level, taking off at one cut not more than a long primer or a pica at the most. The gauge for the thickness of a plate is a pica, or sometimes seven-eighths of a pica.

The electrotype plate, being thus finished, may be mounted exactly as an ordinary stereotype plate.

A complete electrotyping apparatus comprises the following:—

Moulding press.

Metal moulding-pans.

[1] Professional electrotypers use a backing metal composed of lead 91 parts, antimony 5 parts, and tin 4 parts. This amalgam can be purchased.

Wax levelling and cooling table and frame.
Copper wax pot.
Blacklead frame and brushes.
Mould-dressing table and building irons.
Battery, with solution, bath rods, etc.
Backing-up metal pot, with flange and fire-bars, and crane.
Backing-up pans, solder pot, ladles, and a grate.
Lathe, circular saw, and planing machine.
Planing slab and planes.
Bringing-up slab.

The *Dynamo Machine* produces an electric current by the expenditure of mere mechanical power. This current is very much stronger than that obtained from the ordinary battery, and a shell can be deposited by it in from two to five hours, which by the battery process would require nine to twelve hours. The only expense is the driving power and the wear and tear of the machine. Such machines have largely superseded the battery.[1]

Facing of Type, etc.—When treating of inks and colour printing, we saw that copper electros were unsuited to vermilion ink, by reason of the chemical action set up between the copper of the electrotype and the mercury in the ink, which has for effects not only a loss of the brilliancy of the colour, but also a destruction of the face of the block. It becomes necessary, therefore, that electros for working with such inks should be faced with brass, nickel, or steel.

Type and copper plates are also faced with steel to give them durability, and with nickel for the same purpose and to preserve them from corrosion.

[1] Those who require fuller instructions than can be given within the dimensions of a general handbook like the present, will find them in *Stereotyping and Electrotyping*, by F. J. F. Wilson (London: Wymans). Mr. Urquhart's books on *Electroplating* and *Electrotyping* (London: Crosby Lockwood & Co.) are also to be recommended.

Steel Facing.—A copper plate or copper electro can be steel faced by first cleansing it thoroughly, and then suspending it in the depositing bath in a strong solution of sulphate of iron and chloride of ammonium (or sulphate of iron and carbonate of ammonium). The battery power must be fairly strong (three to six Smee or Daniell cells in series), and the anode must be a plate of iron from five to eight times as large as the surface to be faced.

Brass Facing.—To obtain brass facing we want a strong battery (say six cells in series), an anode of brass, and a solution of the constituent parts of brass (copper and zinc), united in a salt obtained by various chemical manipulations of the sulphate of the metals referred to, with carbonate of sodium, bisulphide of sodium, and cyanide of potassium.[1] The solution must be used hot in the bath.

Nickel Facing.—Here the solution is made from the double sulphate of nickel and ammonium. It must be very strong and neutral, that is, neither acid nor alkaline. The anode must be a plate of nickel somewhat larger than the surface to be nickelled, and the battery power need not be a strong one—a single cell will suffice. Sometimes the wax mould, duly blackleaded, is first treated in a nickel bath until there is a thin covering of nickel on it, and then it is removed to a copper bath, where the shell acquires thickness from the deposit there received. This mode is adopted from motives of economy, nickel being much dearer than copper.

[1] The mode of preparing the solution is detailed in Urquhart on *Electrotyping.*

CHAPTER XCIII.

Concerning Gas Engines and the Management thereof—Electric Motors.

Steam power is now rarely found in printing offices except it be in large newspaper offices and the great establishments which count their machines by scores. Gas engines have for the most part supplanted it, while these in their turn are now finding rivals in electric motors. When gas engines are used, the management of them often devolves upon one or more of the machine minders, and it is therefore very desirable that printers should have some notion of how they work and how they should be treated.

All gas engines are now made to work on what is known as the "Otto Cycle," which means that in one and the same cylinder the explosive charge of gas and air is drawn into the cylinder by the outstroke of the piston, is compressed on the return of the piston, and is ignited and exploded or expanded on the next outstroke, thereby developing the power; while the next instroke of the piston expels the consumed gases through the ports and makes way for the next explosive charge. In the early engines there was a complicated system of slides, with ports to ensure the admission of the gas and air, and to effect the ignition of the charge; but a much simpler method now prevails in what is known as tube ignition.

Gas engines should be erected and fixed by engineers conversant with what is wanted. They require to be bolted to firm level foundations, and a circulating system of water

must be laid on to keep the cylinder and the exhaust arrangements from getting too hot; the exhausted gases, too, have to be conveyed away by means of iron piping.

In buying a gas or steam engine, it must be borne in mind that its force is calculated in horse power of three different kinds. There is the "nominal horse power" by which the engine is known, such as "a 3 horse power engine." This hardly ever gives its true force, and is generally much under it. It has some relation to the diameter of the cylinder and the length of stroke of the piston, but for all practical purposes nominal horse power may be considered simply as a fancy mode of describing the size of an engine. Then there is "indicated horse power," which is usually very much greater than the nominal horse power. This phrase means the force exerted by the expanding gases upon the piston, and it is often shown by diagrams drawn by a special apparatus. Thirdly, there is "effective horse power," which is the indicated horse power minus what is required to keep the engine itself running. Hence we may have from a 6 horse power engine a force of 15 or 16 indicated horse power, and of this the effective horse power will be 13 or 14. Effective horse power is the power available for driving the shafts or the machinery, and this is really what every user of power wants to arrive at. It is the force which must be applied to a brake on the axle to counteract the force of the expanding gases or steam, and it is therefore often called "brake horse power." Horse power, by the way, does not necessarily mean the power of a horse, which varies with the strength of the animal, but it means the force which will lift 33,000 lb. one foot in one minute.

In the price lists of makers of engines are usually three columns: one gives the nominal horse power of an engine, the next the indicated horse power, and the third the effective horse power. It is the latter which is really important, though it is to be observed that when makers assert that

their engine consumes so many feet of gas per horse power they usually mean so many per indicated horse power; an uninitiated person would probably think it was the quantity per nominal horse power, and he would be surprised when he found the actual quantity consumed was nearly three times as much as he expected.

The following table will give a general idea of what in a printing office may be expected from gas engines of ½ to 16 horse power nominal:—

A ½ horse power engine (nominal) gives about 2½ horse power effective, and suffices for an office containing 1 Double Royal and 1 Demy Single-cylinder Machines, and 1 Crown Folio and 1 Foolscap Folio Treadle Platen Machines.

A 1 horse power engine (nominal) gives about 4 horse power effective, and suffices for 1 Quad Demy, 1 Double Royal or 1 Double Crown Single-cylinder Machines, 1 Demy Folio, 1 Crown Folio, and 1 Foolscap Folio Treadle Platen Machines, and 1 38-inch Guillotine.

A 2 horse power engine (nominal) gives about 6 horse power effective, and suffices for 1 News Two-feeder Machine, 1 Double Royal and 1 Double Demy Single-cylinder Machines, 3 Treadle Platens, a 42-inch Guillotine, a News Folder, and a Wire Stitcher.

A 4 horse power engine (nominal) gives about 10 horse power effective, and suffices for 2 Quad Demy, 2 Quad Crown, 2 Double Demy, and 2 Double Crown Single-cylinder Machines, 5 Platens, 2 42-inch Guillotines, a News Folder, and a Wire Stitcher.

A 6 horse power engine (nominal) gives about 14 horse power effective.

An 8 horse power engine (nominal) gives about 16 horse power effective.

A 12 horse power engine (nominal) gives about 25 horse power effective.

A 16 horse power engine (nominal) gives about 38 horse power effective, and suffices to drive all the machinery necessary in a provincial daily newspaper office with not more than two Rotary Machines.

It is always best to have a margin of power in reserve, and to allow liberally for special lengths of shafting by short drives.

Managing the Engine.—Now, as to management of the engine after it has been handed over to the printer by the

engineer. It is of the utmost importance that it should be guarded from dust and dirt, and that it should be well oiled with oil of a nature that will not burn or deposit carbon, for nothing causes a gas engine to deteriorate or cease work so soon as inferior oil. There is provided an automatic oil feed for the cylinder, and all that is necessary is to see that this supply is kept up, the reservoir being refilled as required, that it is doing its work, and that the pipes conducting the supply are free from obstruction. To ensure this, pass from time to time a piece of thin wire through the oil conduct pipes to make sure the oil can flow. There are cups on the bearings of the main shaft, and these, sometimes fed with wire and worsted on the syphon principle, should also frequently be attended to. Another important point of lubrication is the crank, and here again a reservoir is provided. All the other working parts need attention with an oil can. The engine should be carefully oiled each time it is started, and during the dinner hour, and whenever else it is stopped.

Starting.—Before starting an engine, see that everything is in order, then light the burners to heat the tube, which will take perhaps four or six minutes; have one or two men at the fly wheel ready to turn it (this sometimes requires considerable strength), and see that the cam and tappit operating the exhaust valve are "set for starting." There are two "lifts" to the exhaust cam, one for starting, which slightly raises the exhaust valve and eases the compression, and the other to be put into action when the engine is running. The only object of this is to assist those pulling at the fly wheel to more easily overcome the compression of the charge on the instroke of the piston before ignition occurs.

When the tube is sufficiently heated, which may be ascertained by carefully looking through the tube casing, turn on the gas at the bag or antifluctuator, and thoroughly fill

it, then turn off the supply-cock and open the inlet-cock on the engine to the point indicated by the mark on the gauge, and then turn the fly wheel as quickly as can be done, drawing in the charge, compressing it, and waiting for the ignition and expansion. Let those turning be prepared to retire at once, for the first explosion will cause the wheel to revolve rapidly. As soon as the engine is started, open the main gas-cock, and shift the cam on the side shaft to the position where it allows the exhaust valve to perform its true function of making a full compression. If the engine loses speed and power it may be that the tube requires renewing, for tubes gradually become corroded, and when they are much so the firing is either late or no ignition takes place at all.

To renew a tube, remove the chimney or casing, and with a pair of gas pliers unscrew the old tube and then screw in a new one; see that the asbestos lining of the chimney is in good order before replacing it.

Cleaning the Engine.—If good oil is used it should not be necessary to draw the piston, *i.e.*, to take it out of the cylinder, oftener than once in four or six months. To draw it the crank bearings must be disconnected, care being taken that all parts, bolts, nuts, etc., are noted so that they may be replaced in the same positions as they were originally fitted to. The piston when taken out should be bathed in paraffin, and the rings should be moved about to free them from dirt, but they should not necessarily be removed, for they are easily broken. The cylinder should be carefully cleaned and all burnt oil or deposit scraped off. The valves also should be taken out, steeped in paraffin, and carefully wiped, as also should their seatings be. If at any time the valves should leak, it will be necessary to "re-seat" them, and to do this mix some flour of emery with oil and smear it over the valve and seat, and then "grind the valve in" on its seat.

There is usually a screwdriver head on the valve for this purpose, and a screwdriver bit in a brace is the best means of revolving the valve. You can ascertain when a good seating is obtained by noting if the bright ring on the valve and seating extends without break all round both. Be careful to remove all trace of emery as soon as it has done its work. A leakage in either the gas, air, or exhaust valve is often the cause of loss of power or actual stoppage.

Working.—One point never to be lost sight of is the quantity of gas supplied. Too much gas makes the charge quite as inefficient as too little, besides sending up the gas bill. The quality of gas supplied by the gas works at times varies, and this may need the readjustment of the gas inlet-cock to a different point.

If the engine is fixed in a cold place likely to be affected by frost, have provided beneath the cylinder a gas jet, which should be left burning continuously in severe weather. If the water in the jacket freezes a new cylinder will be needed, and a new cylinder costs a good deal of money and necessitates a long stoppage. Always run rain water into the cooling tanks if possible, as rain water leaves no deposit or corrosion in the jacket or pipes.

Electric Motors.—In towns where an ample current of considerable voltage is supplied by the electric supply and lighting authorities, electric motors are found to be economical. The usual plan adopted is to have a separate motor for each machine, and thus to turn on the power only when it is wanted.

BOOK VI.

THE ECONOMY OF A PRINTING OFFICE.

CHAPTER XCIV.

General View of the Several Departments of a Printing Office.

We may now sketch the general economy of a printing office—the relationship of the several departments one to another, and the particular processes carried on in each.[1]

The Warehouse.—The operations carried on in the warehouse are many and important. Here will be done the "warehousing" of the paper, both white (or unprinted) and printed. If there are periodicals or serials printed in the establishment, the warehouseman has to take an account of the state of the stock, and as far as possible to "keep it level"—*i.e.*, to see that there are not large numbers of some sheets and few or none of others. When stock gets low, he has to report the fact to the firm, for them (or the publisher) to decide whether reprints are necessary. As custodian of the white paper he has a very responsible task. He must check the bills of the stationers, and see that the number of reams of paper debited to the firm are really received. He must also superintend the wetting down of any paper which is to be worked damp, for he may have careless or inexperienced men under him, who may spoil it by their negligence or incompetence. In establishments where binding is done, the warehouseman also has control

[1] The system for keeping the accounts of the establishment as a whole, and of each department individually, is relegated to a separate chapter, *post*, on Bookkeeping for Printers.

of the girls who fold, count, collate, and sew, stitch, or stab (by machine) the printed sheets. All printed matter leaving the printing office should invariably go through the warehouse, and a strict record of every transaction ought to be kept by some appointed person. Although the wages of the workpeople in this department are generally small, compared with those given in the composing and press departments, the chief warehouseman is well paid, as the responsible nature of his duties deserves; about £3 per week is an average salary in a first-class house.

Besides the warehouseman and his assistants, there are the girls and the errand boys. It is well to dispatch all letters, proofs, etc., that have to be delivered by hand, through the warehouse, and to keep the errand boys entirely in that department.

As a rule, printers are unduly careless as to the situation, the condition, and the arrangement of their warehouses. They regard them as the non-productive portion of their establishments, and keep down the expenses connected with them. This is really an injudicious policy. When estimating the cost of work, the expenses of counting, drying, pressing, and packing up should all be taken into consideration, as they become an integral part of the necessary outlay upon any given job.

In too many cases the warehouse is situated in a cellar or in an outhouse; but this is a mistake. There is no part of the establishment more urgently requiring a good light, free circulation of air, and abundant room. In several of the new offices in London, the warehouse is situated on an upper floor, which is a judicious arrangement, but it necessitates the use of a good hoist or lift. The latter should be entirely distinct from that used for moving formes about.

The chief structural requirements in regard to the apartment chosen for the warehouse are that it should be light, airy, and dry. It is almost impossible to prevent sheets

being smeared and soiled when they are stacked in darkness; indeed, losses through disregard of this consideration amount to a formidable item in not a few large and otherwise well-managed offices. A great quantity of paper is also damaged by damp, and further considerable losses are thereby entailed. If possible, the room chosen should be protected from the dust of the street. In every part of the room the most scrupulous cleanliness should be observed, and the most methodical order should prevail throughout.

In planning a warehouse attention should first of all be given to the space available for counters or boards (as it is on these that the manipulation of the paper takes place), as well as to the space available for shelving, as upon that the capacity for storage will depend. The principal counters are generally disposed round the walls, and, if possible, three or four transverse counters run the length of the room. Between these, spaces may be left for stacks of printed sheets. The more judiciously the space is allotted, the better will be the degree of order and efficiency prevailing. At one corner, a space should be boxed off as a bookkeeper's office, and the head warehouseman's desk should be at the top of the room, with an unobstructed view of the entire department. The counters are generally about 3 ft. 6 in. in height from the ground; they should be very strong, and four or five feet wide. If the room can be warmed by hot air or steam, it will be more comfortable, and otherwise better adapted for the work to be done in it. Immediate access to the street should be provided for, if practicable, by wide opening doors and a lift or hoist.

In the warehouse are kept the cutting, perforating, folding, paging, and stabbing machines, the rolling machines, and the hydraulic and other presses, and the work done on them is here performed.

The Machine Department.—The machine overseer is the head of the printing department. He has under him the

journeymen who superintend the particular machines, and the boys who lay on and take off. Machine minders, or managers, simply see to the making ready of the formes and to the proper working of the machines, and do not either feed or take off. If there is an engineer's shop attached to the office, small repairs will be done there, and any accidents that happen may be rectified by the mechanics who attend exclusively to that department. In the great majority of offices the machine minder is expected to be able to make slight repairs, such, for instance, as can be done at an ordinary bench, with the aid of files, vice, hammers, etc.

The machine overseer is called upon to see a proof of all the work done in his department, and is responsible to the firm for its proper quality. He engages the different workpeople who are under him, and is expected to maintain due order in each branch of his department.

One of the most important of the machine overseer's duties is the keeping of an account of the performances of each machine.[1] This is known as the "reamage," and is carefully scrutinised daily or weekly by the general manager of the establishment. If the production of any one machine falls below what is expected of it, the overseer is called upon for an explanation. In most of the large offices the number of reams turned out in a week is regarded as a criterion of the capabilities of the overseer. It is his interest, therefore, not only to keep the whole of the machinery in the best order, and the whole of his assistants in the best state of discipline, but to look out for a constant succession of work, in order that no machine may long remain idle. This is especially important from the fact that, unlike the hands in the composing room and the press room, who are

[1] A form of accounts will be found in the chapter on Bookkeeping.

very often engaged "on piece," machine hands are nearly always "on 'stab."

The economy of each machine is worked out in some large establishments by fixing for each a certain rate per hour, or per day, which rate should include everything incidental to the production of its work except the matter of ink (this being always charged in the estimate). Thus we have to consider the cost per hour of:—

Labour.	Rags, turps, oil.
Overlooking.	Wear and tear.
Power.	Interest on Capital.

Profit.

The rate varies from 2s. for an ordinary Wharfedale to three, four, or five times as much for a perfector or a rotary. By this means every machine is debited, so to speak, with a certain sum which the overseer is expected to account for by way of production in the day's work or in the week's work, and it is to his advantage to see that the machine does not stand idle too long while making ready, correcting, repairing accidental batters, etc., and to inquire very closely indeed into the cause and nature of spoils, the waste of time and material in replenishing which is at times very great. The main object is to keep the output of the machine as near as possible to its guaranteed number of runs per hour, a point, by the way, which is very rarely reached, undoubtedly because the standard is generally fixed much too high.

When reprints of fine cuts are likely to be required, it is not unusual for the publisher to require the overlays to be returned with the blocks; and if the work has to go to another office, it is expected that the ready-made overlays will be allowed for in the cost of the press-work. These overlays should be made up in large envelopes, with their descriptions legibly written outside, and they should be in the care of the overseer.

The procurement and care of rollers, ink, and other machine room requisites, and the washing of the formes, come within the province of the machine overseer, and he is responsible to the firm for their due discharge.

In offices where the machinery is worked by a gas engine the care of this engine is usually entrusted to the machine overseer, and he must therefore make himself well acquainted with the construction and working of it.

The wages of machine overseers in large offices are very high ; often higher than those of the general overseer of the establishment. From £4 to £6 per week is an ordinary rate of remuneration. The position is one of responsibility, and requires for its proper discharge such wide knowledge, extended experience, and constant steadiness, that a good salary is well deserved.

The machine room always occupies the lowest story of a printing office, in order that the heavy machines may have a solid foundation. Sometimes it overflows this space, and then the smaller machines are placed on the first floor. In all large machine rooms a part is raised and surrounded with thick plate glass partitions. In this room sits the overseer, who thus is able from his seat to observe all that is going on.

The Press Room, when there is one, is superintended by the press overseer, assisted by a deputy, and his subordinates are of course the hand pressmen. He keeps an account of the working of each press under his control, and fills up the bills with the amount of expense that has been incurred on each job. He also, in most cases, has to do with the buying in of supplies, such as ink, parchment for tympans, rollers, etc. He is subordinate to the general overseer of the machine department.

Pressmen and machine minders are expected to submit a copy or proof of each job to the overseer, in order that he may approve or pass it. The overseer preserves this

sheet so that he may have a check upon the work being kept up to the required colour. In some offices this sheet is sent up to the "closet" for approval, and the work is not allowed to proceed until such approval is signified.

The Reading Department.—This is sometimes included under the general name of "the closet," although in some offices the principal only is referred to in these terms. There is one head reader, who is sometimes the press reviser, and then the remainder of the correctors are known as first proof readers. The London wages of an ordinary reader vary from £2 to £2 10s. per week. Classical readers get about £3, and a head reader rather more. Considering the character of the work done in this department of a printing office, the salaries are often not adequate; but the rate is owing to the vicious system adopted in many of the "pushing" houses of not making any charge whatever for reading. Each reader has his reading-boy, generally in training for apprenticeship. The head reader usually engages and discharges these boys.

In some offices the head reader is made responsible to the composing room overseer, and receives the proofs direct from him, giving them out to the various correctors as may be necessary. This is not a desirable arrangement, for it is always best to have the reading department independent of any other, and amenable directly to the principal or the general manager.

The functionary generally known as the press reviser usually has his closet near the machine room. He is expected to give every job a final revision. It is often surprising to see the errors that an entire series of readers will allow to pass, and which the press reviser is expected at once to pounce upon. He should not trouble himself much about the general accuracy of the text. The head-lines, folios, dates, signatures, margins, succession of the pages, and such like are what chiefly concern him. If an

error at any time afterwards be discovered, he may require the machine to be stopped, and the compositors to make the rectification. As a rule the machine hands do not touch the types; if there is even such a slight accident as a "batter" a compositor is called down and expected to make it right. Of course, only a compositor "on the 'stab" is expected to leave his frame for this purpose. This practice, however, is often varied.

The cost of the reading department is estimated at 10 per cent. of the cost of the composing department, *i.e.*, one reader is engaged for every ten compositors. In estimating, a tenth part of the cost of composition is added for the necessary reading.

The Storekeeper's Department.—This is under the entire control of the storekeeper, who is usually a compositor. He receives all the type brought into the office, is responsible for keeping it in proper order, and has to give out the cases of type, the leads, rules, sorts, etc., to the compositors as required. His chief qualifications are, besides honesty, a faculty for keeping everything in its place, and being able at any time to produce whatever kind of material he may have under his care. He should keep an account of everything that leaves his department, and the name of the workman to whom he entrusts anything.

In offices where large numbers of stereo and electro plates are stored up, one person is made responsible for the whole. He has to keep a list of the nature of every plate, to whom it belongs, when it was last used, etc. As many thousands of pounds' worth of these things are kept in some establishments, this position is also a very responsible one. If his time is not fully occupied, he is expected to assist in repairing broken plates, and generally to make himself useful in his own department.

The Electro and Stereo Departments.—Many printing firms, both large and small, now have their own electro and

stereo outfits. They form a separate department under a recognised overseer, who has the entire charge of both electro and stereo plants, and the staff of workmen for each. He is responsible for the delivery to time of all casts, whether mounted or unmounted, flat or curved, to suit the different machines. Besides the various men engaged in the work of taking moulds from formes for both electro and stereo, there are others engaged in backing up the electro shells, casting the stereo plates, bevelling, routing, planing, and mounting either on wood or metal; the latter of whom, known as "pickers," attend to all plates requiring to be repaired, touched up, corrected, or to have new pieces inserted.

The Composing Department includes the overseer and the journeymen compositors. There is the quoin-drawer overseer, a subordinate of the general overseer. The other persons are divided into clickers and job and line hands. In some offices there are special "makers-up," who have to do all the imposing. The men are at work either "on piece" or "on 'stab," but piece hands are occasionally called upon to work "on time." In regard to their internal organisation, the men form a Chapel, with a Father of the Chapel, Stewards, and Clerk and Treasurer as Chapel Officers. The meaning of these terms will be explained in a subsequent chapter.

The composing room should always be a separate branch or department of the printing office. It is the best arrangement to isolate the composition entirely from the press and other work, whenever practicable. A compositor is required, perhaps, more than any other kind of artisan, to rivet his attention upon the work in hand, and the moment his attention is diverted, an opportunity is made for an error. Besides this, composition is, or ought to be, pre-eminently a *clean* operation; press-work is more or less a dirty one. When the two are brought together, both are made alike

unclean, and disorder prevails; the first law of the printing office *must* be "a place for everything, and everything in its place."

To conduce to this order, and facilitate ready access to any of the multifarious tools and materials used in a printing office, it is advisable to have all cabinets, cupboards, and covered receptacles properly labelled with the names of their contents. Cases in racks should not only be labelled with the names and sizes of the type they contain, but a printed specimen line of the type should be pasted on the front edge, and, to ensure the cases being always returned to the same place, they should be numbered, with a corresponding number on the upright of the rack.

If the printing office consists of a building containing several stories, the composing room should usually be on the uppermost floor. The reasons for this are obvious. The prime necessity in a room of the kind is abundant light, and light is generally obtained to the fullest amount at the top of a building. There will be also less vibration and less noise when the room is removed from the street, than in any other situation, both of these conditions being conducive to the comfort, convenience, and expeditiousness of the compositor.

Lighting.—The natural lighting of the composing room may be vertical, by means of sky-lights or a glass roof, or lateral, by windows, or both expedients may be adopted. However the lighting may be arranged, it should not be excessive in quantity, but should be capable of adjustment, by means of shutters, blinds, or awnings. The idea of blinds in a printing office may appear to many as somewhat fanciful, but it is in reality a thoroughly practical and necessary one. Too great a flood of light, owing to the unavoidable blaze of sun-heat in summer, is very detrimental to sight and bodily health. We have known offices planned by the most eminent architects, whose instructions were to pay every

attention to the comfort of the men, yet such offices are absolutely oven-like in summer, owing to the deficiency of means for moderating the sunlight. All sorts of expedients are resorted to in such places to obviate the inconvenience, principally that of pasting up the windows with white paper, or of making paper curtains, suspended by strings. The loss of time and material entailed by this necessity should suggest to any employer of judgment the importance and the economy of attending properly to the lighting arrangements of his office.

Probably the best window-frames for printing offices are those in one piece ; not those that are double, sliding up and down, as in dwelling houses. Many small windows in a printing office are better than a few large ones ; and the small window frames should, preferably, each have a few large panes rather than more small ones. The windows are often made to swing on horizontal pivots placed in the middle. The moment a window of the kind is opened, it is opened top and bottom ; there is an opportunity for the escape of the polluted air as well as for the entrance of the fresh air, and there is an avoidance of the draught which the usual up-and-down frames cause when, as is commonly the case, only one of them is opened. A sloping ledge of wood will prevent the window being carelessly swung too far back. In arranging the plan of lighting, pay particular attention to avoiding all *dark corners* as much as possible ; they conceal dirt, wasted material, and all kinds of irregularities. The light should, if possible, be always on the left-hand side of the frame.

Printing offices also require good artificial light, as frequently quite as much work is done at night as in the day time. The best kind of illumination is undoubtedly that given by incandescent electric lamps, such as those of the Swan-Edison system. These lamps may be hung at intervals from the ceiling, and loose lamps with coils of

insulated wire may be placed where wanted. This kind of illumination is much appreciated by the operatives on account of the steadiness of the light, the greater purity of the atmosphere to which it conduces, and the lowering of the temperature which results from its use—all matters of great importance to compositors.

The electric arc lamps are not desirable illuminants for a printing office owing to their glare and the deep shadows they cast.

Next to the electric light, gas is far the best, especially when used with the Welsbach incandescent mantles, or with Sugg's sunlight burners; argand burners are also good.

We cannot enter into the subject of gas-fitting, further than by saying that there should be a separate gas branch over each frame, or if two frames are placed side by side, as is usual, one branch, if pendant and shaped thus  will suffice for two. If the frames are back to back, of course the one branch will light two sets. There should be a separate burner for each compositor, disposed in the centre of the case, above the thick middle vertical bar dividing the caps from the small caps. The branch should be not more than three inches above the top ridge of the case. A thin cardboard shade, white inside and green outside, should be used to concentrate the light on the copy and the case, and to diminish the glare on the compositor's eyes.

In all well-ordered offices it is a standing rule that no gas be lighted with spills of paper, and infractions of this are visited with fines. There is nothing more dangerous in a printing office than to light gas with a bit of screwed-up paper and then to throw it on the ground, to be perhaps only partially extinguished. Electric lighters or wax tapers ought to be supplied for the purpose; they are safest and cheapest in every way, and, indeed, it is well, where possible, to make one person responsible for lighting and extinguishing the whole of the gas burners.

When neither the electric light nor gas is available, illumination by acetylene gas will be found very brilliant, and if due care is taken it is safe. Failing all the above, paraffin lamps are the best substitutes. These can now be suspended from the ceiling where wanted, and if of the Duplex or "Belge" kind, will give brilliant lights.

In American country offices a convenient lamp holder is used, consisting of an arm and a circle at the end to hold the lamp. The arm fits tightly on the top rim of the upper-case, and the circle is fitted in such a way as to enable the lamp to be placed over the lower-case on either side of the upper-case.

Heating.—The lighting of the room being provided for, its heating should be attended to. Some offices are warmed by hot air or water, others by open fireplaces or gas stoves. In some (too many, alas!) no provision whatever of the kind is made, and the men are compelled either to warm themselves at intervals by the brisk exercise of throwing the arms about in the manner of cabmen, or to light the gas, perhaps, in noonday—in either case causing a loss to the employer, which in a very short time amounts to more than would provide a proper heating apparatus. Into the comparative merits of heated air and water, or gas and coals, we cannot enter here, as they do not properly belong to the printing art. We would remark, however, that, besides being more cheerful, and perhaps most healthful, the open coal fire is useful for drying formes, which is occasionally necessary in every office.

Ventilation.—Neither can we enter much into the question of ventilation—the next point to be considered. Whatever system is adopted it should be *ample:* for a composing room usually contains several occupants, and these frequently are compelled to work many hours in succession. The ventilation of some of our best offices is most imperfect, and the stench—we can use no other word—which is en-

countered in entering them any morning after much night work has been done, is almost unbearable. It is the unwholesome conditions under which printing is at present very largely carried on, and not the business itself, which make it such an unhealthy one.

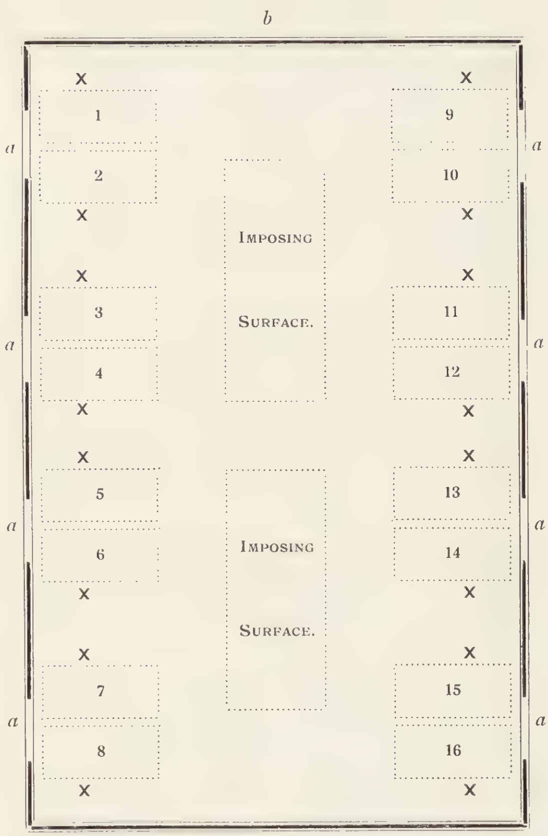
Lifts.—Besides the ordinary communication between the press room and the composing room by means of staircases, there should always, if possible, be a lift or hoist for the purpose of conveying formes up and down. It may be a hoist of the dimensions of a small room, worked by power, or it may be a mere orifice in the floor, through which, by a pulley and rope, a forme may be lowered. Compositors are not well adapted by their sedentary occupation to carry heavy formes up and down stairs, and so carrying them often causes the formes to be broken. If the stairs, however, must be resorted to, a little tram should be run down the right side of the staircase, and the chase slid down the groove, being held, of course, very firmly by the workman in charge.

Arrangement of the Room.—We now come to the arrangement of the frames, racks, imposing surfaces, etc., in the composing room. The diagram on the adjoining page will assist to explain our meaning.[1]

The diagram is intended to represent the arrangement of a small room having eight windows marked *a*. In planning

[1] Those who are fitting up large offices may derive useful hints from the accounts given of the establishments of Messrs. Cassell & Co., Ltd., in the *Printers' Register*, August, 1875; of Messrs. Waterlow & Sons in the *Printers' Register*, November, 1875; Messrs. R. K. Burt & Co., in the same paper for May, 1884; and Messrs. Roberts & Leete in the same paper for February, 1892. These articles describe both the architectural and internal arrangements of the buildings, the lighting, warming, and ventilation, allocation of the various departments, etc. There is a very valuable article on this subject in Waldow's *Illustrierte Encyklopädie der Graphischen Künste*, p. 509.

the composing room much depends on the position of the windows, and the space must be appropriated after the frames have been set in their proper position; that is,



the position which ensures to all the greatest amount of light.[1] The frames, of which there are sixteen, are marked

[1] Of course, wherever practicable, it is best to arrange the frames so that each compositor has a left-hand light. Where this plan is

with Arabic numerals, 1—16. They are placed in pairs, back to back, at right angles to the window; thus each frame gets a fair moiety of the light from each window. The frames, of course, are not placed close together, as the cases overhang slightly at the back. The space between each pair of frames, for instance between 2 and 3, 4 and 5, 6 and 7, is called the *alley*. The compositors stand in the position marked by small crosses (x).[1]

In the centre of the room are placed the imposing surfaces, as marked. They have a clear passage round them.

At the end of the frames, and slightly extending into the passage around the imposing surface, will be placed bulks, if necessary.

These arrangements are especially applicable for news and book offices; if a quantity of large poster type is used, some of the frames may be removed to make way for wood-letter racks, or whatever kind of receptacle the wood type is kept in. Otherwise the wall *b* may be fitted up with shelves for large letters.

Leads and furniture may be kept in various manners already described; if on shelves, the end walls afford convenient positions. In large book offices these materials, with brass rules, etc., are kept in a special room called the *store-room*, by the store-room keeper, from whom the compositors receive them, and to whom they have to return them when done with.

adopted, advantage may be taken of the available space at the back of each frame to obtain room for a galley rest, to be used by the compositor at the next frame, for an italic double case, for a shelf or two for standing matter, or any other convenient purpose. There are not, however, many printing offices in which room can be spared for such an arrangement.

[1] Sometimes in newspaper offices two compositors work in one frame, an italic frame for general use being placed between the imposing surfaces.

Apprentices' Room.—In some establishments the apprentices have a separate composing room to themselves, but generally they work along with the journeymen.

The Closet.—Understood as consisting of the employer and his overseer or manager; this is the most important department in the whole establishment—the heart, in fact, of the entire organisation—for it controls and animates all the other departments of the printing office.

The counting house and offices are usually on the ground or first floor of the establishment. Here are rooms for the principals and their assistants, and desks for clerks and messengers. From this department it is essential that there should be means of promptly communicating with every room in the building, and for this purpose, if the establishment is of any size, speaking tubes or telephones are laid down, so that questions may be asked without the waste of time and energy involved in sending up or down stairs.

We shall now proceed to examine the organisation of the printing office and its more important departments, and state the customs of the trade applicable to each class of operatives.

CHAPTER XCV.

Rules and Regulations Affecting Printers.—The Three Sets of Rules—the Regulations of the House—Codes of Rules.

The trade regulations bearing upon the printer, and the customs to which he is required to conform, may be regarded under three heads:—

1. The rules imposed by the firm by which he is employed, or "the regulations of the house."
2. The rules imposed by his fellow workmen in the house in which he is employed, or the "*Chapel*" rules.
3. The rules imposed by the union to which he belongs (if he is a unionist), or the "*Society*" rules.

These sets of rules will be dealt with in this and the two following chapters.

The Regulations of the House.—The regulations of the house relate to the following matters: Hours of work and meals, holidays, checks on time kept, means for ascertaining the daily work done, and rules for proper conduct and the despatch of business.

All new hands should be distinctly informed as to the regulations of the office at the time of their engagement. If this be not done, unpleasantness may afterwards arise; indeed, the absence of this proper precaution and mutual understanding has resulted in several misunderstandings and lawsuits.

It is, however, sufficient if a printed notice setting forth the regulations is prominently exhibited in each department of the office.

Hours of Work.—The following hours are recommended, as experience in large establishments has shown them to be convenient. They also meet the customs sanctioned by the Compositors' Society and the provisions of the Factory Acts, it being found necessary in most cases that the working hours throughout an establishment should be uniform :—

Monday and Tuesday - - - -	8 A.M. to 6·30 P.M.	54 hours.
Wednesday, Thursday, and Friday	8 A.M. to 7 P.M.	
Saturday - - - - - - - - - -	8 A.M. to 1 P.M.	

Meal Times.—When the above hours are kept, the dinner hour (usually from one till two) is the only time allowed for meals. Time for luncheon[1] and tea is not generally permitted, and there is commonly a notice in the office that no person is allowed then to send for or bring in refreshment, on pain of dismissal.

Closed days usually amount to seven in the course of the year :—

Good Friday.	August Bank Holiday.
Easter Monday.	Christmas Day.
Whit Monday.	Boxing Day.

Wayzgoose Day.

Magistrates and county court judges have on several occasions decided that days which, according to the custom of the house, are "closed days" have not to be paid for by the employer.

It is, however, common to state on the time table that closed days and holidays are not paid for.

Timekeeping.—It is usual to require both piece and 'stab hands to conform to the hours of attendance as set forth.

[1] In many offices this is called "bread and butter time." There is a difference of opinion amongst employers as to the advantage or disadvantage of allowing it. A short stoppage usually takes place about eleven o'clock for slight refreshment, whether the house recognises it or not.

In large establishments there is always a timekeeper, who takes note of the hours kept. Each man as he passes the timekeeper at night takes from a board two metal tickets each bearing the same number. One of these he deposits as he passes the time-box in the morning, the other as he passes after dinner. When all the hands have passed through, the tickets are examined, and each person corresponding with the number is credited with half-a-day's work. Afterwards the tickets are again hung on the board ready to be taken away again. In some offices the timekeeper is replaced by a most ingenious automatic timekeeping clock and recorder, the invention of an American.

At the end of the week there is made up from the timekeeper's book the account of time lost, and from the overseer's book, kept by him for the purpose, an account of the overtime, and a balance being struck between lost time and overtime it is ascertained whether the man has to take more or less than the fixed wages on the payday, and how much.

In provincial offices lost time is usually deducted from overtime at the same rate ; although it may consist of time that would not be paid for at the higher rate of overtime. Full time must always be made up before any overtime is allowed. A man losing three hours, for instance, during the week, and making three hours' overtime, does not receive anything beyond the ordinary week's wages. This regulation, however, is varied in some houses.

In London, overtime and lost time are regulated by Clauses 57 and 31 of the Book and News Scales respectively, which lay down a different rule from the one above stated. (See Chapter XCIX.)

Means for Ascertaining Work Done.—By some firms the workpeople are required to send in a separate ticket showing the time occupied by each job. In others the daily ticket only is written, showing the time devoted to the various jobs which have been done or partially done within

the day. In others, again, both kinds of tickets have to be returned to the counting-house. There is no general rule on the subject. In some houses the wages bills have to be made up and handed in by 4 o'clock on Friday. The week commences from Saturday morning. If any overtime be made on Friday after 7 o'clock, it is charged for the following week.

In other houses the clickers keep an account of the time taken on each job by the several men engaged on it, the complete charge being handed in to the overseer either weekly or monthly when the books are made up.

Forms of job and time tickets and information as to their use are given in the chapter on Bookkeeping.

Rules for Conduct and the Despatch of Business.—The necessity for rules for regulating conduct in every printing office where more than one person is employed is obvious. But the full measure of evils that can be developed in an office can only be learned by experience, and in the same way only can the necessary rules for their prevention be laid down.

There are some evils and offences which no laws can cure ; such as idleness, inefficiency, carelessness, destructiveness, and dishonesty. But others which arise may be easily suppressed if the regulations of the house are properly and rigidly enforced.

The following rules are founded on those in vogue in some of the oldest metropolitan offices. Even where they cannot be adopted altogether, they may furnish useful hints, and indeed require but little adaptation to the circumstances of any respectable office :—

1. Punctuality must be strictly observed. Five minutes' grace is allowed each morning. If more than 30 minutes are lost during the week, all time will be deducted in full.

2. No person is allowed to leave the premises during working hours without the permission of the manager.

3. No meals are allowed on the premises.

3*a*. A lad appointed for the purpose may be sent out for lunch and at tea time for refreshments, but at no other time.

3*b*. No kettle boiling, cooking, or tea warming by means of the gas lights is allowed.

4. Smoking is strictly prohibited, also lighting pipes on the premises after work has ceased.

5. No one is allowed to light the gas but the person appointed for the duty, and he must use an electric lighter or a taper.

6. All gas lights must be turned down during meal times, and at other times when not required.

7. Each person must keep to his own department as much as possible.

8. Each person will be held responsible for the cleanly and orderly state of the place he occupies.

9. Throwing type, quoins, paper, etc., is strictly forbidden.

10. Unnecessary conversation is to be avoided. Singing, whistling, etc., in any part of the premises are rigorously prohibited.

11. Compositors are to receive their cases from the storekeeper, his assistant, or the overseer, free from all pie or improper sorts, with clean quadrat and space boxes, both roman and italic. They must return their cases in the same clean condition.

12. When a compositor receives letter, furniture, etc., he is to return any portion not used in as good state as he received it, the same day, if possible.

13. When a case is taken out of rack, the compositor is to return it into the proper place immediately after he has done with it.

14. Cases are not to be placed over others, or on the floor, or under the frames.

15. Compositors are to impose their matter and pull a proof as soon as the matter is made up, unless directed otherwise, and to correct the proof without unnecessary delay.

16. The proof, when pulled, is to be given to the reader, or sent to such person as may be directed, the copy in regular order to accompany the first proof, and the corrected proof the revise.

17. A compositor is not to detain an imposing stone longer than the nature of the business may require.

18. Head-lines or other materials on galleys used during the course of a work are to be cleared away as soon as the work is finished.

19. When a work is done, the compositor, before beginning another work, unless otherwise directed, is to clear away the formes, taking from them the head-lines, blank lines, and odd sorts, as well as the

leads and reglets, which, with the furniture of each sheet, and the matter, properly tied up for papering, is to be given to the storekeeper or overseer.

20. Sweepings of frames are to be cleared away before [a certain hour] each day. Matter broken by accident must, whenever possible, be cleared away on the same day.

21. The saw, saw block, lead and rule cutter, bowl, sponge, lye brush, shears, bellows, etc., are to be returned to their respective places as soon as done with.

22. Letter boards, window frames, case racks, etc., must be scrupulously kept free from pie.

23. Wrong founts, battered or foreign matter, must not be put into the back or quad boxes of the cases.

24. Each forme is to be properly washed and carefully placed in the racks provided, or handed over to the custody of the person appointed.

25. Machine minders must see that points are inserted in book or other formes when perfect register is necessary. They are responsible for their machines being cleaned daily, and kept in good order.

26. A machine is to be cleaned only while it is standing, and on no account while it is in motion.

27. Machine boys must keep the space apportioned to their machine clear of waste paper and other litter.

28. No person other than the one in charge may touch the engines; and no one is allowed in the engine room or foundry except the persons authorised.

29. Strict attention to be paid to notices posted in the office.

Fines.—The following fines are also imposed occasionally, the proceeds being devoted to a sick fund or some other benevolent object. The manager is empowered and expected to enforce the fines, but deduction for fines can now only be made in strict accordance with the Truck Act, 1896, as to which see Chapter CI. :—

Any person dropping type and not picking up same will be fined 2d.

Any person eating at any other than the proper times will be fined 2d.

A boy will be appointed to each machine, to be responsible for it being covered before leaving; should he omit to do this he will be fined 2d.

Care must be taken that work is not spoiled "by missing the lay of the sheet;" any machine boy allowing the sheet to run through the machine, making a set-off on the back, will be fined 3d. for each offence.

Any person found touching any machine in any other department than that to which he belongs, will be fined 1s.

The following rules for the composing room, founded on those adopted in the office of Mr. De Vinne, New York, meet some exigencies not provided for in the preceding, and supply a code of management which is both instructive and suggestive:—

1. When the compositor on plain work receives copy, he must get instructions as to type, measures, leading, indentation, spacing, and minor details, and whether the work will or will not be electrotyped. If the work is to be electrotyped or stereotyped, the compositor must use high quadrats and spaces, and put bearers freely in all open places. This part of his work must not be deferred, so that the bearers will have to be marked in the proof.

2. On peculiar work, the compositor must carefully read over the written instructions on the copy before he begins work. If he does not clearly understand them he must get further explanation. He must not go on until he *knows* what he has to do.

3. The compositor must make sure that he has, or can get, all the sorts and materials he may need before beginning composition. He must get together, at once, all the leads, quotations, rules, or extra sorts that are needed for immediate use.

4. If special sorts have to be got from the foundry, he must make a careful estimate by count of what will be required, and give the estimate to the overseer in writing. He must never begin a job on which he will soon have to stop for want of sorts without notifying the overseer of the coming delay.

5. He must never turn for sorts when he has choice of other letter. He should not turn at all unless he has permission to do so, and knows that the sorts he needs will be procurable in time.

6. When it is noticed that a fount of display letter, or a length of leads, or any kind of materials, is frequently out of sorts, a memorandum must be made in writing and placed on the overseer's desk.

7. All lines of composition must be justified so tightly that they will stand unsupported in the stick. Clickers must refuse to make

up matter that is too short or too long for the leads. The expense of rejustifying slack matter must be borne by the compositor in fault.

8. When ready to impose a forme he must ascertain, if he can, on what style of machine the forme is to be printed. He must also make sure that the chase selected will fit the machine.

9. A forme must not be locked up so tightly that spaces and quadrats rise. Select furniture and quoins with care. Never allow a sidestick to pass a footstick. Never force a quoin in any place from which it cannot be easily moved. Tighten quoins gradually, going over each side twice, so that the pressure against the centre-bars will be uniform and the type and bars will be kept square. Electrotypers are not to mould, and pressmen not to print, but are to return to composing room, all formes that hang, bow, or are out of square, or with type off its feet. Planing down must be done before the forme is finally locked up.

10. The violent planing down of a forme will be regarded as evidence of the ignorance of the workman who does it.

11. Compositors are expected to correct two proofs without any demur. If they fail to correct what has been plainly marked in the second proof, the extra cost of the following proof, revision, and correction will be charged to them.

12. Proof must be taken as soon as the forme is locked up. The proof must be clear, not over-inked, nor on too large paper.

13. The proof, with its copy, must be hung on the hook near the reader's desk.

14. When the read proof has been returned, the matter must be corrected at once. Unless otherwise ordered, corrections will take precedence over all other work. Second proofs will take the same order. At all times keep copy and proof together.

15. Corrections must be made chiefly in stick. A battered letter may be taken out of the forme with a bodkin, and letters of the same thickness may be exchanged by means of a bodkin, but justification will not be allowed on the stone. Nor will any compositor be allowed to use a bodkin for correction who habitually bruises type.

16. Each compositor is responsible for the safety of the copy and proof in his keeping. When not in actual use, he must not allow them to cumber the frames; he must keep them in his drawer.

17. Cases must not be piled upon frames without permission.

18. Cases of italic or display types that have to be taken from a standing rack must be returned to it as soon as composition therefrom is done.

19. Frames are for general and not for private use. Makers-up

must not litter cases around them with materials that make them inaccessible to the compositors. Nor should compositors keep on cases near them galleys or material that they do not urgently need. Whatever can be kept in drawers or under frames will not be allowed on cases.

20. Pie, either in cases or under frames, must be cleared up and distributed at five minutes' notice.

21. Matter broken by accident must be distributed the same day.

22. The secreting of pie, the throwing of pie in the old-metal box, and wanton waste of materials are inexcusable offences.

23. Makers-up must clear the stone as soon as they have taken proof. They must see that compositors clear away their own corrections. Sorts must not be taken from fount without permission.

24. The mixing of sorts from different founts, even if the types are from the same mould, will not be allowed.

25. Machine minders must report the absence of points in book formes before they begin making ready. They must see that these points are fifteen inches apart, that they cannot be disturbed by unlocking the forme or otherwise, and that they make a strong, decided perforation of the sheet.

26. The efficiency of workmen depends very largely on the keeping of every type and tool in its proper place. Workmen who are negligent and slovenly cannot be tolerated.

As already remarked, cases will occur which no rules could anticipate, and these, if they affect the closet, are best left to the overseer or to the firm, or if they are connected with the mutual relationship of the men themselves, are best left to the arbitration of the chapel, as will be afterwards explained.

A good overseer—firm, just, and judicious—is a necessary adjunct to any code of regulations. The best rules may be evaded, and even distorted from their obvious intentions, if they are not interpreted in a sensible and equitable manner.

Many offices have special prohibitions which need not here be specified. Thus, in some establishments the compositors are allowed to send out the boys for refreshments, etc., during the hours of working; in others this is strictly forbidden under pain of dismissal. In some, the potman

is allowed to come in at certain hours and take orders for beer, etc.; in some, a "coffee man" is allowed to call and take orders for non-intoxicating beverages, eatables, etc. These are points which must be left to the individual discretion of employers. We must caution all who are concerned, however, against the laxity that not unfrequently sets in after ordinary working hours, and during the time that is allowed as overtime.

Apprentices are often demoralised by being compelled by the journeymen to run errands to the public-house, etc. They ought never to be permitted to do so. There is usually some one in the establishment who can be entrusted with such commissions, without destroying the apprentice's sense of self-respect or wasting the time he ought to spend in learning his business.

In very few offices, possibly, can the whole of the rules given above be acted upon; but all may act upon their spirit, and prevent in one way or another the evils that they are intended to repress.

CHAPTER XCVI.

THE CHAPEL.—Its Origin and Nature—Its Composition and Functions.

A MEETING of the members of any department of a printing office, whether apprentices or journeymen, is called a "Chapel." Why it was so called is a moot question. Some suppose it was because the first printing office in England was thought to have been in a chapel in Westminster Abbey. Certain it is that the title is an ancient one. Its objects are as follows:—

1. To maintain the customary rights and privileges of the trade.
2. To settle disputes arising in the office, without having recourse to external adjudication.
3. To form a medium of communication between the employed and their employers, or between the employed (if society hands) and the trade society.

In large offices a code of laws has been from time to time formed at different chapels. Some of these relate to the prices to be paid for work. If the house recognises society rules, however, it is only the application of those rules to particular incidents that requires to be considered at a chapel.

Incidental to the business of the chapel may be the collection of the subscriptions of the journeymen to their trade society. The arrangements for a wayzgoose, or an annual dinner or excursion, are also considered at a chapel. Occasional cases of accident or distress may be relieved

by means of collections made at chapels. Representations to be made to the closet on the one hand, or the trade union on the other, are first considered at a chapel, which appoints one or more delegates for the purpose.

The chapel, in short, in any considerable office, is the caucus of the journeymen. All are expected to be present, and if present to abide by the decision of the majority. The members in chapel assembled may, however, refuse to admit a journeyman; or one who has been admitted may be expelled by being "sent to Coventry"; that is, no person is allowed to speak to him on any consideration, on subjects apart from business matters, until he conform to the laws of the chapel.

Apprentices in the last year of their time frequently have the privilege of attending all chapels connected with trade matters, but not of voting on any question.

The overseer, as the representative of the employer, is usually excused from attending chapels. This law, however, is relaxed at chapels called to consider such matters as the wayzgoose, which do not affect the chapel as a meeting of workpeople.

Finance.—The general expenses of the chapel are defrayed by a payment from each member of one penny or more per week, which amount has to be paid regularly along with the society subscription. A small fine is usually imposed, at the general monthly chapel, on every member who is a month in arrear with his subscriptions to the chapel fund. The fines are rigorously exacted before any money is credited as subscriptions. Any default in the payment is left to be dealt with as the chapel may think fit.

When Chapels are Held.—Chapels are held at stated intervals, either every month or once a quarter. An agenda paper is sent "round the frames" announcing the date and business, and the fine for non-attendance. The

chapel may be held in the house or outside as convenient, or as the length of the agenda paper may require; but short chapels called for one object only are held inside, when the men congregate round one or more of the imposing stones. A special chapel may be called by requisition, *i.e.*, a request, giving the reason for calling the chapel, is written out and signed by four members. This request is handed to the "father," whose duty it is to call a chapel at the earliest moment, when he asks the first of the signatories to state the case.

The workmen hold their meeting by congregating round the imposing stone. The chapel is frequently held in meal times, the tea half-hour, where it exists, being a favourite opportunity, as tea can be partaken of while the chapel is deliberating, and thus no time is lost. A member may have a chapel called at any time by depositing a shilling with the "father"; but should it appear to the members that the circumstances are frivolous or vexatious, this sum is forfeited. On a certain day in every month, however, a chapel is usually called for general purposes, when all the members must be present. Persons not answering to their names when called at the opening, or absent during the whole chapel, unless by sanction of the "father," are fined; but if a workman has to leave off work not less than an hour before the time specified for holding the chapel, he is generally held to be exempt.

The "father" is the president of the chapel. He is usually elected in the first week of January in each year. It is his business to call all meetings of the chapel, and to preside over them; to receive and answer all communications connected with the trade; and as he is considered to represent the chapel, it is his duty to head all deputations to "the closet," as the employers or their deputy or the overseer are called, on any business connected with the trade.

When a journeyman comes into a society house,[1] the father is required, within three hours after receiving notice of his arrival, to wait upon him and ascertain if he is a member of the society or trade union. For neglect of this duty the father is fined. The father, in consideration of performing all these duties, some of them of a very onerous and frequently of a very delicate character, receives a small annual salary, paid quarterly, two pounds per year being the amount in some offices.

Next in importance to the father is the "Chapel Clerk." This official is also elected the first week in January. He is entrusted with the collection of all moneys payable to the trade union, and has to pay them over to the secretary once a month. He acts, in fact, as agent of the trade union. But besides these funds, he collects funds raised in the office for specific purposes, and has to disburse them in the manner agreed upon by the chapel. He has to keep certain books of accounts, which are carefully audited every month. He also has to keep the minutes of all the chapels, records of decisions of cases referred to the trade committee of the union, and all reports of delegate meetings of the trade. For these services he is paid an annual salary; frequently about £3.

To act as a check upon the father and clerk, two auditors are elected, also the first week in January. They audit all the accounts of the chapel, and are paid a small sum (say one shilling) for each audit.

The introduction into the chapels of society houses of persons who do not satisfy the trade regulations is prevented by the surveillance of the clickers, who have to give notice to the father within one day of any stranger joining their companionships.[2] In default, the clickers are

[1] A "society house" is one in which the rules of the workmen's trade society or union are recognised.

[2] For companionships, see Chapter XCVIII.

fined. When reported to the father, the new-comer has to show his credentials, etc., as already mentioned.

The chapel appoints a certain number of *delegates* (the number being fixed according to the number of workmen employed in the establishment) to represent the office at the general councils of the trade. All persons appointed to wait on the trade committee, or selected to attend delegate meetings of the trade society, receive from the chapel funds a small sum (about 1s. 6d.) for each night's attendance.

Occasionally a committee is appointed to investigate some dispute that has been brought before a chapel. Each member of such committee is remunerated for his services during such investigation, at a certain rate (say 8d.) per hour, from the chapel fund. The expense so incurred has to be repaid to the fund by the party proved to be in fault, together with such fine as the chapel may think proper to inflict.

So far we have regarded the chapel rules as they affect the workmen; let us now see how they provide for the due order and regularity of the office, and thus legislate for the employer as well as the employed. They limit the working hours according to the hours observed in the house. For instance: "Any person working before eight o'clock in the morning, or between twelve and one (the dinner hour), or half-past four and five (the tea half-hour), or after seven o'clock in the evening, unless instructed to do so by the closet, shall be fined 6d." (These regulations will vary, of course, in different offices.) There is also a fine imposed upon any man striking another. Any member, however, desirous of bringing a complaint against another, has only to give the nature of the complaint in writing, with his name attached, to the father, when it is read over to the chapel assembled and duly adjudicated upon.

The principal evils which have to be provided against

in a printing office, and which properly come within the powers of the chapel for adjudication, are the subject of such rules as those following:—

Mixing Founts.—Any person mixing founts without the permission of the storekeeper is fined 6d. Any person keeping extraneous sorts, such as half fractions, Greek, italic, or any peculiar sorts, in his case, except those sorts which are in regular use, is liable to a similar fine.

Castings-up.—No person is allowed to proceed with the making-up of a work beyond three sheets without having first submitted the cast-up to the closet, or having obtained the permission of the father of the chapel for so doing. All castings-up, when approved, are to be entered by the clicker in the cast-up book, the penalty for the non-observance of this rule being 1s.

Making-up.—No companionship is permitted to proceed beyond two-thirds of a work without having obtained orders from the closet to incur the charge of "No return." In default, the clicker is fined.

Leaded Work.—Any person proceeding with a leaded work without being furnished with leads, unless ordered to do so by the closet, with the understanding that he will be paid for the time employed in leading out the matter, is fined. Any person proceeding with turned sorts without orders for the "turning" to be done at the expense of the closet, is liable to a further fine.

Taking Sorts.—Any person detected taking sorts, that is, type, leads, galleys, etc., from another's frame, without permission, or taking another's share of letter without his consent, is fined.

Leaving a Foul Stone.—Any person leaving type, furniture, corrections, boards, pages, etc., on an imposing stone is fined, unless the materials are removed within ten minutes after a request is made to that effect.

Returning Sorts.—Any person requiring Greek, Hebrew,

or any peculiar cases from the store-room, must return them on the completion of the work.

Distributing.—A fine is imposed for distributing a work composed by another companionship and neglecting to secure the heads, notes, etc.

Clearing Away.—All books and jobs when worked off are to be cleared away within three days after notice has been given to that effect. Cap., small cap., and italic lines are to be picked out and tied up separately. No packet, however, should consist of less than twelve lines.

Formes for Distribution.—All formes for distribution are to be well laid up and well washed on a board in the sink, or, if laid up in the composing room, to be taken in galleys to the sink and thoroughly washed.

Furniture and Laying-up.—Should any companionship want only the furniture of a work that has been composed by another companionship, the latter is required to lay up the formes within one hour of being requested to do so. When works, after being worked off, are kept standing and used for second editions, etc., all laying-up for furniture is done at the expense of the closet.

Throwing; Leaving Lights.—A fine is invariably imposed upon any one throwing type, quoins, paper, etc., at another while in the office. A fine is also imposed on any one leaving the house at any time without extinguishing the gas which lights the particular work on which he has been engaged.

The General Bill.—Every clicker should be required to produce a general bill of every work or job he makes up, within a fortnight after it has gone to press.

It is a useful enactment that no questions shall be put to the vote that can be decided by the rules recognised in the office; and that no appeal should be heard from any member who has been fined, until he has paid his fine.

Apprentices.—All apprentices are to be brought under the

operation of the rules of the office, and have the protection afforded by them in every case in which they can possibly be brought to meet their position. On the occasion of any young man coming out of his time, he is to wait upon the father and inform him of the circumstance.

Matters not provided for in the rules of the office can be dealt with at the discretion of the chapel. The rules should be printed, and every workman who attends the chapel should be required to take a copy.

Wherever practicable, it is also advisable for a copy of the chapel rules to be submitted to the manager, as the representative of the firm, who should be requested to give his formal sanction thereto, and to initial a copy.

CHAPTER XCVII.

The Trade Unions.—Their Objects—the London Society of Compositors—the Typographical Association—the London Printing Machine Managers' Trade Society—Master Printers' Associations.

As in all other important trades, the operative printers, or a considerable proportion of them, constitute Unions or Societies for their mutual protection and assistance. These Societies are supported by the contributions of their members, and some of them are possessed of large funded property saved out of such contributions. No workman is obliged to become a member, but where a man enters an office which is called a Society house, he practically has to join the Society or find employment elsewhere. While on the roll of members, each person is bound to conform strictly to the rules of the Society and to obey the directions of the Committee of Management; otherwise he may be expelled, and made to forfeit all benefits to which he would, as a member, have been entitled.

The objects of the Trades Unions are mainly these: To see that each man receives no less than the recognised wages or piece prices for his work; to see that the customs of the trade so far as they benefit the workman are maintained; to assist members out of work, to find employment, and to render them pecuniary assistance while unemployed; to fight the battle of those who have to resort to the law courts, or are brought into them on any question affecting the trade; and to organise concerted movements for ob-

taining an increase of pay, or for resisting attempts to depreciate the position of the operatives.

The chief Trade Union in the Printing Trade is the London Society of Compositors, which now (July, 1900) numbers about 11,500 members. Large as this number is, a considerable body of compositors at work in the metropolis are non-unionists, and hence there are many establishments worked regardless of the Society rules, and regardless also of the "scale" agreed upon between representative masters and workmen. Such establishments are by the unionists termed "unfair houses"; while those that abide by the "scale" and recognise the Society's rules are termed "fair houses." No member of the Trade Union is allowed by it to work in an "unfair house."

The London Society of Compositors.[1]—The following are the chief regulations of the London Society of Compositors bearing upon the conduct of the compositor[2]:—

Eligibility, Admission, and Subscription.—Every compositor working as a journeyman, overseer, storekeeper, reader, or in any other capacity in a fair house, or who may afterwards prove his right to work as a journeyman, either by indenture or other satisfactory evidence, or by a clear card of membership from a recognised society, is eligible as a member, and pays 8d. to 1s. per week subscription; except in the case of aged and infirm members. There is also a small entrance fee.

Violation of Rules.—Compositors who have violated any of the Society's rules, and are at work in any capacity in a house closed[3] by order of a delegate or general meeting, or

[1] The offices are at 9 St. Bride Street, Fleet Street, E.C.

[2] See Rules of the London Society of Compositors, as amended and revised, second edition, February, 1891. Printed for the Society. Price 6d.

[3] A "closed" house is a house in which the Union forbids its members to work.

who have knowingly accepted work at less prices than those warranted by the scales and customs of the London trade, are only admissible on the payment of such an entrance fee, not exceeding £10, as the Committee may determine.

Turnovers.[1]—Persons known by the name of "turnovers" are to be rebound to an employer by means of a legal or written witnessed agreement within a period of one month from entering an office; and unless this agreement is produced at the completion of their servitude, they are not admitted to this Society without the sanction of the Committee.

Powers of the Committee.—The Committee of the Society meet periodically, to consider and decide upon all cases of dispute, and answer all questions submitted by chapels or individual members respecting the prices and customs which may arise in the book trade, and for the general control and management of the Society. They are authorised, in cases of emergency, to call in all requisite assistance, to open and maintain correspondence with the different typographical societies, transmitting or receiving any information necessary. The decisions given are binding upon every member, subject to appeal to a delegate or general meeting. When any trade dispute or other matter requiring investigation arises in any chapel, the Committee are empowered to summon members to give an explanation, and if they neglect they are fined.

Duties of Chapels towards the Society.—Each chapel has to appoint one of its members as a collector, to gather the subscriptions from every journeyman or member employed in the office or chapel. It is also the duty of the father of the chapel to make a quarterly return of the number of journeymen employed in the office, specifying the number

[1] A "turnover" is an apprentice who during his term of apprenticeship has left the master to whom he was indentured and has gone, or been "turned over," to another master.

on piece and 'stab respectively, the number of apprentices and turnovers, the number of hours worked overtime, together with any special circumstances which may exist in the mode of working in the office, which are contrary to the scales or customs of the trade or to the rules of the Society.

Any member working in any office wherein there is an encroachment made, or about to be made, on the authorised customs or regulations of the trade, has to give information to the secretary.

No member is allowed to accept a situation in any office the character of which is unknown or doubtful.

Trade Disputes.—The Committee can, in the event of any dispute affecting the scales or customs of the London trade, require members of the Society to give up their situations, and, until a delegate or general meeting of the trade be called, temporarily forbid members doing any work not paid according to scale. Any member thus relinquishing his situation is placed on strike pay, generally at the rate of 25s. a week. The benefits of this rule are only awarded to such members as are directed by the Committee to give up their situations. Members who are unjustifiably discharged, or who have made a sacrifice on behalf of the Society, and who prove this to the satisfaction of the Committee, are remunerated as it may determine.

Finding Employment.—The chief regulations as to obtaining employment are, that a "call-book" remains open during certain hours daily, in which unemployed compositors may insert their names in numerical order. Every morning the names on the book the previous day are called over (by a member appointed each day by the members present whose names appear on the book) in numerical order, and, on answer being made, the names are inserted in the current day's list in like order. Offers of work are termed "calls." The "calls" are given to the members whose names appear

first on the current day's list. Any member must accept whatever "call" may come to his name in numerical order, or have his name erased from the books for the day, except in the cases of sick members and those sixty years of age and upwards. Employers, overseers, or their agents may choose workmen from the list, irrespective of the position in which their names appear on the book; but the members so chosen may, if they think fit, refuse such employment, unless of those present they are first in order on the book. Should any member, after having obtained a "call," forfeit such by neglect or irregularity, he is suspended from the benefits of the call-book for one month.

Casual Engagement.—Members called in to assist in the composition of bookwork or jobbing may take a casual engagement for not less than a day on the establishment, but not of greater length than a fortnight; at the expiration of which they must be either paid upon the piece, or, if not discharged, then be entitled to a fortnight's notice.[1]

Establishment Hands.—Hours and Wages.—Members engaged on the establishment, on book or jobbing work, or on weekly newspapers, are not to receive less than 38s. per week, for which payment they are not to attend any number of hours exceeding 54 in each week; overtime is to be charged in hours, and each fraction of an hour is to be charged as one hour.

Piece Hands and "Farming."—Members in offices are

[1] The object of this rule is stated to be to discountenance the right of an employer to call in assistance for a few hours, and pay for that assistance at 8d. or more per hour. The compositor must be engaged at per day, and paid at least 6s. 4d. for each nine hours' work or attendance when the number of days does not extend to an entire week. A compositor under this rule is not bound to go parts of two days to make up one, but must be paid for the first as a day, whether it be a full one or not, unless he be employed the whole of the following day. A compositor, however, is not prevented from accepting less than a day's employment, if paid by scale for what he composes.

not to be called off the piece to be put on the establishment for any description of composition unless engaged for at least a fortnight. Nor can any member contract, by way of farming, to do any description of jobbing or bookwork, or accept an engagement on any work so contracted for.

Clearing Hands.—Aged or infirm members of the Society may be engaged by overseers as clearing hands on the sanction of the chapel being obtained. They are paid a minimum rate of 30s. per week. They must not be called off to work on composition, either on line or on 'stab, and their duties are confined to laying up formes to be cleared, and clearing generally.

The Typographical Association.—In nearly every town throughout the country there are societies with general objects similar to those of the metropolitan society. With the object of securing combined action and avoiding contradictory regulations, these have formed a kind of federal union, called "The Typographical Association." [1]

The rules of the Association state that the objects of the organisation are the regulation of the number of apprentices and hours of labour, the maintenance of a fair standard of wages and of honourable working conditions; making provision for its unemployed and superannuated members; providing a funeral allowance for its deceased members; and taking a general supervision of all matters affecting the interest of the printing profession.

Hours of Labour.—It is prescribed that fifty-six hours per week is the maximum of working time on piece or 'stab, the local rules of each town to define when a day's work begins and ends (providing for the day preceding the publication of newspapers), with a proportionate advance for overtime and Sunday work. No local society is to be

[1] The offices of the Association are at Campfield Chambers, Deansgate, Manchester.

eligible for admission that does not maintain a "'stab," or equivalent piece, scale of at least 24s. per week.

Notice of Discharge.—Not less than a fortnight's notice must be given to members discharged from regular employment, and an equivalent notice must be given by members desiring to leave a situation. The same notice is to be given if members engaged on establishment wages are required to change to piecework prices, and *vice versâ.*

Apprentices.—The maximum number of apprentices in each recognised office is three ; and until an office has been in operation at least twelve months, the number of apprentices is confined to one only. When the probationary clause has been complied with, and a proprietor has fully employed at least two journeymen for the previous six months, it is competent for a branch to permit a second apprentice ; or when six men have had regular work, under similar conditions, the apprentices may be increased to the full number, namely, three.

Boys intended as apprentices must be bound or practically withdrawn within three months from their introduction, and no apprentice is allowed to work for any other employer than the one to whom he is legally bound for the time being.

Members are required to give their local secretary immediate notice of any breach of rule. Pending further action, all casual labour is withheld and withdrawn from an employer who persists in such infringement.

To discountenance the pernicious effects of runaway apprentices, Branch Secretaries immediately inform the Association Secretary when a turnover is introduced into an office, or an apprentice leaves in search of work, with particulars as to whether the boy is liberated by the death, failure, or retirement of his employer.

Whenever there is a dispute between the Society and the employees in any town, the Secretaries notify apprentices

and turnovers seeking or being offered employment the fact that the dispute is pending; they also inform the parents or guardians of apprentices of the nature of the dispute, and explain to them the results of such a step on their future prospects as workmen; and if, after such caution, an apprentice assists an employer with whom there is a dispute (except he is legally bound to him), or a turnover engages where there is or may be a strike, his name is forwarded to the Association Secretary, who duly registers it, that the offender may, on application for admission into any branch, "be dealt with as may be deemed expedient." This means that he is either not allowed to join at all or only allowed to do so after a term of probation or on payment of a fine.

"*Smooting*."—No member of the Association is permitted to work for any other employer than the one by whom he is engaged (if any member out of employment can be obtained), except in case of accident, when it is lawful to render assistance if requested to do so. Transgression of this rule is called "smooting."

"*Farming*."—No person can retain membership in the Association who farms or contracts for any newspaper, periodical, or job (*i.e.*, who undertakes to do such a quantity of work, or to fill such a space, for a lump sum), or indentures to himself an apprentice, or initiates any one in the art of printing other than as provided for in the rules.

Borrowing Matter.—No matter is allowed to be borrowed from, or lent to, an "unfair" office under any circumstances whatever.

All other matters are regulated by the local rules of the branches. Members of the latter, dissatisfied with the decision of their local committee, can appeal to the Executive Committee of the Typographical Association.[1]

[1] Much useful information concerning the internal regulations of the London and country trade may be found in the "Report of Proceedings of the Meeting of Delegates from the Typographical

The London Printing Machine Managers' Trade Society.[1]—This Society is composed of machine managers, or "minders." It is younger, smaller, and less powerful than the Compositors' Society.

Admission of Members.—A person applying for admission to the Society must at the time of the application, and during three consecutive years previously, have had the management of a printing machine, and must also have served an apprenticeship of seven years.

Machine Apprentices.—In offices where only one journeyman minder is employed only one apprentice is allowed by the Society; where there are four journeymen two apprentices are permitted, provided the journeymen have been in the machine room six months. There must be three additional journeymen, subject to the foregoing regulations, for each additional apprentice. The time allowed for a lad to be "on liking" is six weeks; but should he not be bound at the expiration of that time, members must immediately report the same to the Secretary. Where it is known that a London firm has a country office, the two establishments are taken together in dealing with the limitation of apprentices. No member is allowed to have an apprentice bound to him.

Societies of the United Kingdom and the Continent, held in London, 1886." The answers of Mr. C. J. Drummond to the questions of the Royal Commission on the Depression of Trade and Industry were reprinted in the 38th Annual Report of the London Society of Compositors, 1886; and the Evidence and Report of that Commission were issued in January, 1887, as a Parliamentary paper. (Price 2s. 4d.)

For Scotland there is the Scottish Typographical Association, of which Mr. J. Templeton is the Secretary. The office is at 50, Wellington Street, Glasgow. In Ireland there are local societies, but only in a few of the towns.

[1] The offices are at Printers' Hall, Bartlett's Passage, Fetter Lane. Mr. J. Dewar is the Secretary.

Hours and Wages.—The Society recognises that a week's work is 54 hours. It requires that its members shall receive as wages not less than 38s. per week, with 11d. per hour for overtime.

The Master Printers' and Allied Trades Association.—The associations hitherto considered have all been unions of the workmen, and for a long time there was, in London at least, no organisation of the Master Printers by which questions affecting the trade at large could be dealt with. The want of this was ultimately realised and the Association mentioned at the head of this paragraph, under a slightly different name, was formed in 1891, the immediate result being the codifying of the rules and customs of the trade, so far as composition was concerned, and the production of the New Scale set out in Chapter XCIX.

The objects of the Association, as defined by its rules, are to discuss matters of common interest to the trades represented, with a view to decision and, if necessary, concerted action; to watch such legislation as may affect the trade interests, and to take action if necessary; to suggest to public bodies, corporations, and large companies more practical scheduling for contracts; to afford a central body for intercommunication and negotiations in trade disputes, copyright questions, etc., and to do all such other things as may appear of benefit to the trades concerned.

The Association consists of such employers as subscribe thereto. The annual subscription varies with the size of the member's establishment. It is one guinea for every fifty or part of fifty persons of all grades employed in all departments of that establishment, the maximum being twenty-five guineas. The business is conducted by a Chairman, Vice-Chairman, and an Executive Committee elected for three years. There is a permanent Secretary, Mr. H. Vane Stow, F.S.S., and an office at 24, Bedford Street, Covent Garden

A monthly circular noting matters of business interest and importance to printers is sent to each member.

Much useful work has been done by this Association in arranging differences between masters and men, and occasionally between one firm and another. Rules provide among other things that no member or firm joining the Association shall conclude any modification of terms of labour with his men without first submitting the matter to the Committee, and obtaining their views; that every member who shall receive any notice from his men requiring any alteration in the working hours, or customs, or rate of wages, shall send notice thereof to the Secretary for the consideration of the Committee, and that if any strike should occur without notice the same shall be reported immediately. This, it is pointed out, does not limit freedom of action, but subjects it to the knowledge and advice of the Committee.

Provincial Master Printers' Associations.—Somewhat similar associations are to be found at Belfast, Birmingham, Bradford, Burnley, Dublin, Edinburgh, Glasgow, Leeds, Leicester, Manchester, Newcastle, Norwich, and Reading. These and the London Association are in touch with one another.

Associations of Newspaper Proprietors.—In addition to the above there is the Newspaper Society, whose offices are in New Bridge Street, Blackfriars, E.C., whose Secretary is Mr. H. Whorlow, and whose object is to act in the common interests of newspaper proprietors throughout the kingdom. There is also a union called the Linotype Users' Association, and in addition a company composed of newspaper proprietors called the Press Association, Ltd., for the collection and dissemination of telegraphic and other news.

Trade Charities.—The leading trade charity is the Printers' Pension, Almshouses, and Orphan Asylum Corporation (offices, 20, High Holborn, W.C.), to which both masters

and men subscribe at their will, and whose objects are sufficiently indicated by its name. A young journeyman cannot be too strongly recommended to join it as a member and subscribe to it according to his means: it may prove a good investment for himself and his wife and children. The Stationers' Company, one of the old City Guilds, also confers benefits on those of its liverymen who are in need.

CHAPTER XCVIII.

Companionships.—The Clicking System : Payment by Hours—Accounts.[1]

In order to secure uniformity in the appearance of the work, and expedition in its execution, it is usual, in the large London offices, to form the compositors into companionships, or small bodies of men, with a leader at the head of each, competent to take general orders from the overseer and to secure their being properly carried out in practice. Those, too, who constitute the companionship are trained to work together, and the capabilities of each individual are also more particularly ascertained than if he were not subjected to such close supervision as the companionship system secures.

The chief of the companionship, or "'ship," as the word is generally abbreviated, receives the copy from the overseer or the "closet" for all the men associated with him, and makes out the general bill, writing his name in the "bill book" as "J. Smith & Co." (for companions).

There are two ways of conducting a "'ship." In one of them each compositor makes up his own matter, and charges for it independently of his fellow-workmen ; while in the other the making up is performed by the chief man only, called the "clicker," who may, however, call in assistance. In the latter kind of companionship, the members of

[1] This chapter was written by Mr. Robert Hilton.

it merely compose and correct their own matter. We will describe both systems, beginning with the first, which is a much more old-fashioned one than the second, but still has its supporters.

Old System.—When the work is given out, A, the first who has copy, sets and makes up his take into pages, the style having been previously decided, and "passes the make-up," together with the "pass book" and gauge of the pages, to B, the second in copy. The "pass book" is a book used for recording the number of lines taken and lent in making up. A, for instance, may have borrowed from B some matter to complete his last page, or he may have more matter than he wants to make up a page, and may transfer that to B. If A passes lines over to B, he must also compose and pass over with them the headline and white line (or cut-off rule, should there be any in the plan), including them in the number of lines passed over, or "lent." If B begins a page, he sets the head and white lines. The pass book is kept as follows, if A has borrowed ten lines:—

Compositors' Names.	*Title of Work.*
Jones to Brown.	Practical Printing.

Folio 7—7th in sig. B.

Running Head: Practical Printing.

Owes	Owing to
A .... 10 lines	B .... 10 lines

The portion of copy, it may be here stated, that is allotted to a man must always be completely composed before he asks for more. B, having set the whole of his copy, notes as well as text, now begins, without delay, to make up. We will suppose he has had to borrow 5 lines from C, who

follows him. B, when he has done, passes the book in the following form:—

B to C. Practical Printing.

Folio 12—12th in sig. B.

Head: Companionships.

Owes		Owing to	
A	10	B	5
		C	5

C passes the making up to D, and perhaps borrows 12 lines from D, when the book will stand as follows:—

C to D. Practical Printing.

Folio 21—5th in sig. C.

Head: The Clicking System.

Owes		Owing to	
A	10	B	5
C	7	D	12
	17		17

The first form shows that on passing the first making up, there are 10 lines due to B. When, however, B passes the making up, he diminishes the debt due to him by borrowing 5 lines, and the name of the creditor C appears in the second column for 5 lines. When C passes the making up, he not only pays himself these 5 lines, but becomes a debtor to the amount of 7 lines. His name is therefore transferred to the first column, and the number of lines he owes is placed against his name. Should D pass the making up to A and take 14 lines, he will wipe out A's indebtedness of 10 lines and make him a creditor for 4, he will also convert his own credit of 12 into a debt of 2, and the following will be the form of the table:—

D to A. Practical Printing.

Folio 33—1st in D.

Head, as before.

Owes		Owing to	
C	7	A	4
D	2	B	5
	9		9

The total of the lines owed and owing must, as will be seen, always correspond. No misunderstanding or error will occur if this rule is uniformly observed.

When the first sheet is out, A and B impose and take the formes to the proof press; the second sheet is imposed by C and D, the third by E and F, the fourth by G and H. When the proofs are sent in by the reader, the compositor whose pages are first in the sheet usually lays up the formes, and he who is last locks them up and takes them to the proof press. When there is a return of letter, the formes are laid up by those whose turn it is to impose. If letter for distribution be equally shared, the quantity composed by each companion will be nearly uniform. When this principle has been carried out it has been found at the end of a large volume that the difference between the quantity composed and imposed by each companion has not varied either way more than a few pages. The system also tends to prevent disputes, and to facilitate the getting out of work. If any derangement arises in the account of transfer of lines, it is best to pay off the lines appearing in the book and commence the account afresh.

Compositors working under this system charge only for complete pages in making out their weekly bills, specifying the number of pages in each sheet set by them. The pass book forms a check against overcharging. Lines left over at the end of the work are settled by mutual arrangement

amongst those concerned. If any compositor has a quantity of matter not made up at the end of the week, he charges "on account" for so many pages as it will make, deducting them again when they appear in their places in the make-up book. This is called "horsing" in the technical slang of the printing office. Such "fat" pages as half-titles, titles, with their accompanying blanks, and tables are usually balloted for.

By this system, also, the compositor, having to make up his own pages, is more likely to acquire a thorough knowledge of this branch of the business than under the plan next to be described; but the latter is probably more expeditious, as it saves the time lost in passing the make-up.

The Clicking System.—The overseer hands the copy to the clicker,[1] and gives him directions as to the general style of the work, perhaps a specimen sheet[2] of another work, or a specimen page, and he also instructs him as to when the sheets are wanted to be sent out. The clicker then calls the members of his 'ship together, communicates such general directions as may be necessary, and he also informs them what cases to put up and what letter to distribute. Having done this, they proceed with the distribution of their letter. The clicker, at the same time, gets from the storekeeper the necessary materials, such as leads and sorts, and everything, in fact, that he wants for the making up. He then provides himself with a rough

[1] The clicker is the chief of the companionship, and answers to the "ganger" of some other trades. In some offices the overseer selects the clicker; in others, he selects the men, and they select as their clicker the compositor whom they think best qualified for the position, this, in fact, being the general rule.

[2] Most publishers require a specimen page of new works to be set up and submitted to them before the composition is given out. This is returned to the printing office, and forms a guide for the clicker in regard to the style to be followed.

book of blank paper, which he rules according to the following form.

In the first column he sets down the name of each compositor as he takes copy; in the second, the folios of the copy, so that he may be able to ascertain instantly in whose hands any particular piece of copy may be. In the third column he notes down, opposite to his name, the number of lines each man has composed, as fast as the galleys are brought to him. In the fourth he sets down such remarks concerning the copy as may be necessary, also any incident that requires to be recorded in regard to the progress of the composition, or any circumstances concerning the companionship.

Compositors' Names.	Folios of Copy.	Lines Composed.	Remarks.

The clicker gives out, as the first take of copy, but a small portion, and the first two or three compositors get less than those who follow. This is to prevent any delay in the make-up; for those who have the shortest takes, of course, get them finished first, and in this way they are enabled to "empty" in regular order.

During the time the first takes are in hand, the clicker will employ himself in setting the half-head, head lines,

folios, white lines, signatures, side notes, poetry, and other incidental matter. He proceeds, however, with the making up as soon as a sufficient quantity is composed. He knows when the first takes are finished, by the compositors applying for more copy. As he receives each man's galley, he counts the lines and enters the number against the compositor's name in the book already referred to, this entry serving as a check against the man's bill when he presents it at the end of the week.

When the first sheet is made up, the clicker lays the pages on the stone, and then informs the "quoin-drawer overseer,"[1] or the person whose duty it is to provide him with chases, furniture, etc.

The clicker now proceeds to "dress" the forme: *i.e.*, he puts in the furniture, side and foot sticks, takes off the cords from the pages, fits the quoins, having previously seen that all the pages are square and firm, and finally locks up the forme. He then takes it or sends it to the proof puller; or if there is no special proof puller, he pulls the proofs himself; however, the proof having been pulled, it and the copy are at once taken to the reading closet. It is a good plan to have a series of pigeon holes in the closet, or a few paper weights, labelled: "First proofs," "For revision," "For press," etc., and to keep the copy and corrected proofs under each designation, and separate from any other. In some offices all the proofs, revises, etc., are kept on lines, being placed there by the proof puller. They are thus always under the eye of the overseer, who knows at once what work is waiting for the readers.

[1] The quoin-drawer overseer is usually a compositor who is entrusted with the charge of the furniture, chases, and other material of the kind kept in the composing room. He is distinct from the storekeeper, who keeps the type, sorts, etc. The exact relative duties of the two are not, however, very strictly defined.

In the great majority of offices no matter is made up until the first and second proofs are corrected in slip, and frequently not until the author's proofs are returned. The worst of the corrections are then done before the type is made up into page form.

In this way the compositors are kept continuously engaged at their frames, while the clicker is free to attend to any incidental matters that arise, which are done more systematically and expeditiously by one man than if each of the companions had to do a portion by himself. As soon as the work is begun, if there is a sufficient supply of leads, sorts, etc., direct progress can be made without waiting for anything, or one man delaying another.

Sometimes, especially when there is an unusual quantity of notes, poetry, or other "fat," which in the ordinary course the clicker ought to set, he finds that he must have assistance, or he will not be able to impose as fast as the matter is set up. In this case he calls to his aid one of the companions to do this kind of work. If this companion has not finished his take, the compositor next to him in copy sets it up, right on to where he himself begins; or, if there is a great deal to set, the man who took copy last finishes it for him. This assistant compositor is credited with the lines he has already set, and is remunerated for the other part of his work by being credited with a certain number of hours—that is, with hours he is engaged "on time."

The reader corrects the proofs and forwards them to the clicker, who instructs the compositor whose name appears first in the sheet to "lay up the forme" and correct his matter.[1] The proof is passed regularly on from one compositor to the other, until each has corrected his own matter and the entire forme is finished. The last person

[1] The clicker or his assistant usually corrects the errors in the headings, notes, or those portions which have been set up on time.

who corrects, locks up the forme, and takes it to the proof press along with the first or foul proof. The compositors are never taken from their frames except to correct their matter, which, as we have already pointed out, saves a great deal of time, but, on the other hand, tends to make them mere "type lifters," and gives them no opportunity of completely learning the business.[1]

When the last taking of copy is given out, the clicker is expected to apply to the "closet" for more work, so as to prevent his companions standing idle. Very often, however, one companionship, with one clicker, will have three or four works going on at the same time; so that if there is a scanty supply of copy or of letter for one work, the clicker employs the companions on another. If the work is nearly finished, and there is no more copy to be given out, then the lines in the entire work are counted off and set down in the book, and each does what he can for the general benefit till the formes are ready.

Making out the Bill.—Let us see how the clicker and his companions are paid for their work. At the end of the

[1] It is one of the disadvantages of a large office, as far as the compositors are concerned, that a person may remain a member of a companionship and be kept from the third or fourth year of his apprenticeship up to the close of his career as a compositor, merely setting up and distributing lines of type. He remains entirely in ignorance of the methods of making up, making margin, or imposing, as he is never called upon to perform them; and even the display parts of the composition, the mode of setting poetry, and many other things are kept from him. Many men so situated are not able to pull a proof, and it cannot be wondered at if they find their trade a monotonous one, and constantly deplore the fate which brought them into it. It is, indeed, persons of this class who, perhaps not unreasonably, are heard complaining of the business and comparing it so unfavourably with others. It is they, too, who despise technical handbooks and opportunities of learning anything more than they know. So that they can "pull out" a sufficient number of lines to make a decent bill at the end of the week they are quite satisfied,

week[1] the clicker makes out his bill in the following manner. He first ascertains, by casting up, what amount of work has been done during the week. He then counts up how many lines each compositor has set, and estimates the number of "hours" they represent. An hour is supposed to be equal to a thousand ens; so that the bill is not made up for so many thousands, but at so many "hours."[2] Having done this, he refers to his book to see how many hours of time-work proper have been charged, adding his own time, which is fifty-four for the week, and in addition any overtime he may have worked. He adds all together, and the total is the full number of hours to be paid for out of the bill. By reducing the sum total of the bill into pence, and dividing it by the number of hours, he gets at the price per hour which the bill pays. In other words, the entire value of the work, if each man set his own matter and had his own fat, is estimated, and this sum divided by the number of hours. In this clicking system, therefore, the fat, such as the title, blanks, short pages, folios, whites, head lines, cuts, etc., are all made up by the clicker and thrown into the general bill; hence, each man gets his fair proportion of it when the bill is made out.[3]

[1] In offices where wages are paid on Saturday, the bills are usually made up to Thursday night, and delivered to the overseer on Friday morning. In those that pay wages on Friday, which include the largest and best-managed offices in the metropolis, the bill-making is done a day earlier.

[2] In other words, to find the number of hours, ascertain how many ens there are in a line. Then divide 1,000 by that number; thus, if there are 50 ens in the line, $1{,}000 \div 50 = 20$, and 20 will be the number of lines to the hour. Sometimes to compensate for extra trouble involved, owing to the peculiarities of copy, etc., a line or two is given, or a line or two may be deducted. This is a matter for mutual arrangement between the companionship and the clicker.

[3] In the old companionship system, the fat is distributed by "jeffing" or "throwing quads." The compositors gather round the stone, and

In some offices, however, there are slightly different methods adopted for paying the clicker; although the men are always paid in the way described. Sometimes the clicker is only paid for the time he is actually engaged on

throw for the fat, tables, etc. The following is an account of the method, taken from Southward's *Dictionary of Typography*, 2nd edition, p. 58: "The plan adopted is to take nine em quads—long primer being mostly chosen; these are laid on the imposing surface for the inspection of the whole of the party interested in the matter at issue. One of them takes the quads, shakes them up between his two closed hands, and throws them on the imposing surface, after the manner of throwing dice, when the number of quads with the nicks appearing uppermost are counted, each person having three throws (raffle fashion), the highest thrower being the winner of taking his choice of any 'fat.' This performance is not so much in vogue now as it was years ago, before the 'clicking' system came up; then it used to be of daily occurrence in the composing room, when the title, index, blanks, tables, etc., of a work were put in hand, for the compositors to throw who should have the first choice of the 'fat.' The title sheet was divided into lots, say: 1, title and blank; 2, preface; 3, dedication and blank; and so on, according to the prefatory matter introduced into the work. Words of Greek, for which one shilling per sheet is charged, were also 'thrown for'; but the clicking system does away with all that, by making a general bill; so that each member of the companionship comes in for a proportionate share of 'fat' as well as 'lean.' There are some technicalities connected with 'throwing,' *viz.:* If when the quads alight on the 'stone,' one should ride on the other, it is called a 'cock,' and the thrower has to pitch them up again; if no nicks turn up it is called a 'miss'—and by some loving swains it is called a 'Mary' or a 'Susan'—and counts for nothing. The average winning throw is seven, and is termed the 'witch.' Nine is considered an excellent throw, and is very rarely reached. On very rare occasions, however, three blanks have been thrown, or three nines have made their appearance consecutively by the same thrower, but this is very exceptional." The result of this system is often to cause disputes and dissatisfaction, and it always occupies a great deal of time in a very unseemly manner. In the clicking system the man who sets up the most lines in the cleanest manner gets, as he ought, the largest proportion of the fat.

the work. Sometimes the fat is divided equally, and not proportionately to their work, among all the men engaged. In others, the clicker charges the same number of hours as the man who has earned the most. This latter plan, however, is bad in principle ; for it affords ground for dishonesty. A clicker may give the best and fattest copy to the quickest compositor, and thus enhance his own bill.

There is also a system of organising three classes of companionships. The first-class companionships have all the best kind of work, and are paid sevenpence or eightpence per hour. The second-class take the medium work, and are paid sixpence per hour. The third and lowest class get all the inferior work, for which they are paid fivepence per hour.[1] In such cases the men are not paid for the fat, which is claimed by the employer in remuneration for the clicker's labour. A new man is generally put in the third-class companionship. If he is a quick and clean workman he is advanced to the second class. The first class is kept constantly engaged ; if there is a scarcity of work, some is taken from the second class.

Considered as a whole, the plan of permitting the com positors to choose their own clicker is probably the best and most equitable one. If he does not work to their satisfaction they can, and probably soon will, replace him. As he is paid out of the general bill, the employer knows he is only paying what the work is really worth, and at the same time the men are getting on with it as quickly as possible, for their own sake, if not for his.

The clicker makes out his bill in a book called the "bill book," which specifies the full amount of the work done and the proportion belonging to each man. On the appointed morning this book is passed round the office, and the clickers

[1] This plan is not practicable in offices which conform to the regulations of the London Society of Compositors.

fill it up according to the work done in their companionships, signing at foot, "[Name] & Co." The amounts payable to each man are transferred from this to the general wages list of the office,[1] if the men's wages are not paid through the clicker.

If all the work done during the week cannot be exactly cast up, the clicker is allowed in some offices to write an "account line," being the estimated value of the work done, but not charged. It is deducted when the final bill for the entire book or job is made out. Sometimes (too frequently, in fact) clickers overdraw their account, and the amount of the overdraft goes to the debit of the companionship's work in the following week. The work done to wipe out this balance is called "dead horse." Many clickers involve themselves in much trouble, and cause much loss to their employers, by habitually overdrawing; while if one or two men leave the companionship, the rest have to bear more than their share of the overdraft. Sometimes, too, when there is a change of clickers, the outgoing one leaves as a legacy to his successor a heavy "account line," and the liquidation of this has in some instances led to litigation.

Imposing and Distributing Letter.—When all the compositors in a 'ship are called upon to take a share of imposing, as described in the first of these companionship systems, there are sometimes disputes as to the laying up

[1] It is common to say, "How much do you write?" not "How much do you charge?" The bill book is, in well-managed offices, carefully examined by the overseer to ascertain the diligence or the capability of the different men. If they write a very small bill (provided there is plenty of work in the office), the fact is attributable either to their having lost time in coming late, going away early, standing idle, etc., or owing to their inability to work more expeditiously. As a rule, employers do not like small bills; they would rather have a smaller staff and the members of it receive higher wages. The progress or diligence of apprentices working on piece is also gauged by the amount of bills they write.

of the forme for distributing, the rule being that the person who imposes must lay up a forme. It is best, therefore, to keep an exact account of the different pages, in the following form:—

IMPOSITION SCALE.

Signatures.	Compositors' Names.							By whom Imposed.
	Smith.	Jones.	Brown.	Bell.	Watt.	Cox.	Leslie.	
A								
B								
C								
D								
E								
F								
etc.								

This scale should always be kept by the compositor in the making up, who, when he gives it away to the person who follows him, marks down the number of pages he has made up opposite to the proper signature, and under his own name; also, when he imposes, he inserts his name in the column appropriated for that purpose.[1]

[1] The usual plan is for the compositor who imposes to enter the respective number of pages in the imposition scale, as sometimes one man may have two takes in the same sheet, which would cause

Each compositor generally keeps a book of his own checking that of the clicker. It contains memoranda of all the work done by him.

a second entry or an alteration. As a rule the compositor who has most pages in the first sheet is the one to impose it, and he who has the largest number on the scale in the subsequent sheet imposes it, and so on; but some prefer that all the companions on the work should draw a figure for the first imposition, and let the scale govern it afterwards.

CHAPTER XCIX.

Prices of Composition in London and the Principal Provincial Towns.

Both in London and in the country compositors are paid under two different systems, known respectively as 'Stab—a contraction for "Establishment"—and Piece Work. Under the first, compositors are paid by the week of so many hours, with extra per hour for overtime. Under the second, they are paid according to the work accomplished, calculated by an agreed scale.

For more than a hundred years, a custom has prevailed in the London printing trade for the settlement of the rates of wages to be paid to compositors, whether on time or on piece, namely, by a standard scale agreed to by both employers and workmen. The first scale of prices was determined in 1785, and this has from time to time been modified. The last revision of the London Scale took place in 1891, when seven representative master printers, selected at a general meeting of the trade, and seven representative compositors, selected by the members of the London Society of Compositors, met at Stationers' Hall, and after a series of sittings, agreed upon the scale for book, jobbing, and news work which is now in operation.

The custom with regard to the Scale has become so well established that, except in offices which are known to the compositors working in them not to recognise it, but to have a scale of their own, there is no need to make any stipulations or agreements on entering employment, or in perform-

ing any ordinary work; for both the compositor and his employer are bound by the terms of the Scale—the one cannot lawfully demand more, and the other cannot lawfully refuse to pay less, than the rates provided for in the Scale.

In Provincial printing offices the rates of pay vary according to locality, and there is not the same certainty as regards payment as there is in London; but owing to the prevalence of local Trades Unions and branches of the Typographical Association in nearly all the important towns, there are recognised rates, and difficulties seldom arise.

In offices, whether London or Provincial, where the standard scales are not recognised, the rates of pay are settled either by the custom of the house, made known to the workmen before the work in question is undertaken, or by mutual agreement: in the absence of either, the employer is liable to pay what a tribunal considers fair and reasonable.

Printing offices in which the Scale is recognised are termed "Society houses"; those in which it is not recognised are termed "non-Society houses." Among the members of the Trades Unions the former are often referred to as "fair," and the latter as "unfair" houses.

It is impossible to set out the prevailing rates of any that are "non-Society" offices. As a general rule, the prices are below the others; but in London and elsewhere there are a few large firms whose terms are such that, while not binding themselves by the regular Scale, their men are enabled, owing to the character of the work upon which they are engaged, to earn equally good wages.

In the London trade, and in that of most of the large country towns, there are two kinds of establishment hands, corresponding to the two departments of news work and book or job work.

News work, again, is divided into weekly news, daily morning news, and daily evening news.

Another modification of the 'stab scale is dependent upon the hours between which the daily period of work is comprised, and brings in the question of "overtime."

A still further modification is occasioned by the fact of the work being done on Sunday.

London Wages and Piece Prices.—The London Scale is so important, that at the end of this chapter it will be found printed in full, with special indexes to facilitate reference to it. Here we can deal only with two or three matters of the most universal interest.

Wages.—The minimum establishment wages for a compositor, whether engaged on book, news, or jobbing work, are 38s. per week of 54 hours. The apportionment of the 54 hours is mutually agreed upon between the employer and the journeymen in each office, the ordinary working hours, however, being from 8 A.M. to 7 P.M. from Monday to Friday (with an hour and a half for meals), and from 8 A.M. to 2 P.M. on Saturday.

On morning newspapers time work is paid at not less than 11½d. per hour; on evening newspapers, 11d.; weekly papers, 10d.

Overtime.—A compositor, whether on piece or 'stab, if working overtime, is entitled to additional pay for each hour or fraction of an hour worked between the ordinary time of closing an office and 8 o'clock of the following morning. The rates vary, and are determined by Rule 57 of the Book Scale, and Rules 7, 11, and 31 of the News Scale.

Sunday Work, too, is paid for at extra rates, which are fixed in Rule 58 of the Book Scale, and Rules 12 and 32 of the News Scale.

Piece Work.—Work done on piece is paid for at so much per 1,000 ens. We have in Chapter XLVII. shown how the number of ens in a page are calculated, and how the money value of the work is found. The table given on pages 364 and 365 shows the rates of payment for book or jobbing

piece work in London, and that on page 370 the rates for news work.

In book and jobbing work where the number of letters amounts to 500 or more, a charge is made for 1,000 ; if under 500, no charge is made. An odd threepence in the amount of the bill is suppressed ; but when the calculation works out at something above threepence, sixpence is charged.

Bastard founts—that is, founts of one sized face cast on to the body of another—if of one remove, are cast up to the depth and width of the two founts to which they belong. Further details must be sought for in the Scale itself.

Provincial Rates of Wages.—As a rule piece work is not adopted outside the London radius, except for newspapers. In the table following, the price per 1,000 for three different bodies—brevier, minion, and nonpareil – is given, as paid respectively on daily and weekly papers ; but in some of the towns named the piece scale is practically inoperative. This table, which was originally drawn up by Mr. H. Slatter, the then general secretary of the Typographical Association, has been revised to the month of July, 1900. Attention must be given to the notes at the end of it.

HAND COMPOSITION.

TOWNS.	Minimum Weekly Wages.			News Piece Prices. Per 1,000 ens of own body.						Number of Hours Per Week.			Minimum Rate for Overtime Per Hour.		
				Weekly.			Daily.								
	Jobbing.	Weekly News.	Daily News.	Brevier.	Minion.	Nonpl.	Brevier.	Minion.	Nonpl.	Jobbing.	Weekly News.	Daily News.	Jobbing.	Weekly News.	Daily News.
T. A. Branches—	*s.*	*s.*	*s.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*				*d.*	*d.*	*d.*
Accrington	30	30	—	6	6	7	—	—	—	54	54	—	8	8	—
Ashton	33	33	—	7	7	7	7	7	7	52	52	—	—	—	—
*a*Aylesbury	26	26	—	—	—	—	—	—	—	58	58	—	6	6	—
Banbury	26	26	—	6	6	8	—	—	—	54	—	—	6	6	—
Barnsley	30	30	—	6¾	6¾	7¼	—	—	—	54	54	—	8	8	—
Barrow	31/6	31/6	—	6½	6½	6½	—	—	—	54	54	—	9	9	—
Bath	28	28	—	—	—	—	—	—	—	54	54	—	7¼	7¼	—
*a*Belfast	32/6	34	42	6¼	6¾	7¼	7	7½	8	52½	52½	50	10	10	18
Birmingham	34/6	34/6	45	7½	7½	8¾	8	8	9½	54	52	50	10½	10½	12
Blackburn	31/6	31/6	34	6½	6½	6½	6½	6½	6½	54	54	52	9	9	10
Blackpool	31/10½	31/10½	—	6¾	6¾	6¾	—	—	—	51	51	—	9	9	—
*a*Bolton	33	33	35	6½	6½	7	6	6½	7	52	52	52	10	10	10
*a*Bradford	32	32	42	6¾	6¾	7	6¾	6¾	7	51	51	51	9	10	13
Brighton	30	30	38	6	6	6	6¼	6¼	6¼	60	60	56	6	6	8
Bristol	32	32	40	—	—	—	—	—	—	54	54	54	8	9	10
Burnley	30	30	—	6	6	7	—	—	—	54	54	—	8	8	—
Bury	30	30	—	6	6	6	—	—	—	54	54	—	8	8	—
*a*Cardiff	30	30	40	6½	6½	7	7	7	7½	54	54	54	8	8	10
Carlisle	29	29	29	5½	5½	6	5½	5½	6	54	54	54	8	8	8
*a*Chester	30	30	—	6¾	7	7	6¾	7	7	52	52	—	8	8	—
Chesterfield	30	30	—	6	6	7	—	—	—	54	54	—	7	7	—
Colchester	26	26	—	5	5	5	—	—	—	52½	52½	—	6	6	—
Coventry	29	29	28	5½	5½	—	5½	5½	—	55	55	55	7	7	7
*a*Darlington	30	30	36	6	6	6	6	6	6	53	53	53	8	8	10
*a*Derby	31	31	36	6¾	6¾	7¼	7¼	7¼	7¾	54	54	50	8½	8½	10
Doncaster	30	30	—	5	6	8	—	—	—	54	54	—	6	6	—
Dudley	28	30	—	6	6½	7	—	—	—	54	54	—	8	9	—
Durham	28	28	—	5½	5½	5½	—	—	—	52½	52½	—	8	8	—
Exeter	22	24	24	6	6	6	6	6	6	52½	54	54	6	7	—
Frome	25	25	—	5¼	5¼	5¾	—	—	—	54	54	—	6½	6½	—
Gloucester	28	28	28	—	—	—	—	—	—	52½	52½	52½	7½	7½	7½
Grimsby	28	28	—	—	—	—	—	—	—	52½	52½	—	8	8	—
*a*Guildford	30/6	30/6	—	6½	6½	8	—	—	—	54	54	—	10½	10½	—
*a*Halifax	27	27	27	6½	6½	7	6½	6½	7	52	52	52	8	8	8
Hartlepool	32/3	32/3	—	6¼	6¼	6¼	6¼	6¼	6¼	54	53	53	8	10	10
Hereford	25	27/6	—	6	6	7	—	—	—	55	55	—	6	7	—
Hertford	28	28	—	6	6½	7	—	—	—	57	57	—	6	6	—
*a*Huddersfield	30	30	38	6¼	6¼	6½	6¼	6¼	6½	51½	51½	51½	8	8	9
*a*Hull	31/6	32	42	6½	6½	6½	8	8	8	54	53	50	9	9	12
Hyde	33	33	—	6½	6½	6½	—	—	—	54	54	—	9	—	—
Ipswich	26	26	32	5	6	7	7¼	7¼	7½	54	54	52	8	8	8
Isle of Man	27	27	27	6	6	6	—	—	—	52	52	52	6	6	7
Kettering	27	27	—	5½	5½	5½	—	—	—	54	54	—	6	6	—
Kidderminster	26	26	—	5½	5½	6½	—	—	—	55½	55½	—	6	6	—
Lancaster	29	29	—	5¾	5¾	6¼	—	—	—	54	54	—	7½	7½	—
*a*Leeds	34	35	46	6¼	6¼	6½	6½	6½	6¾	52½	52½	48	9½	11	11½
*a*Leicester	32	35	38	6½	6½	6½	6½	6½	6½	52	52	50	9	9½	—
Limerick	29	27	—	6	—	—	—	—	—	54	50	—	8	—	—
Lincoln	30	30	30	6	6	6	6	6	6	54	54	54	8	8	8
Liverpool	35/6	35/6	45	8½	8½	9	9	9	9½	51	51	50	10	10	14
Londonderry	27	27	—	5½	6¼	5¾	—	—	—	60	60	—	6	6	—
Macclesfield	28	28	—	6	6	6	6	6	6	55	55	—	7	7	—

HAND COMPOSITION.

TOWNS.	Minimum Weekly Wages.			News Piece Prices. Per 1,000 ens of own body. Weekly.			News Piece Prices. Per 1,000 ens of own body. Daily.			Number of Hours Per Week.			Minimum Rate for Overtime Per Hour.		
	Jobbing.	Weekly News.	Daily News.	Brevier.	Minion.	Nonpl.	Brevier.	Minion.	Nonpl.	Jobbing.	Weekly News.	Daily News.	Jobbing.	Weekly News.	Daily News.
T. A. Branches—*con.*	*s.*	*s.*	*s.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*				*d.*	*d.*	*d.*
Maidstone	28	28	—	5½	5½	5½	—	—	—	54	54	—	7	7	—
Manchester	35	35	42	8	8	8½	9	9	9½	50	48	48	10	10	12
Merthyr Tydvil	25	25	—	5¾	5¾	5¾	—	—	—	54	54	—	6	6	—
Middlesbro'	31	31	32	6	6	6	6	6	6	52	52	52	8	9	9
*a*Newcastle	33/6	35	42	—	7	7½	8	8	8½	53	52	50	9½	12½	15
Newport	28	28	29	6	6	6	6	6	6	54	54	54	7½	7	7½
Northampton	30	31	31	6½	6½	7½	—	—	—	52	52	52	8	9	9
Norwich	23	24	35	5	5¼	6	5½	6½	7	54	54	—	6	6	9
Nottingham	35	35	38	6	6	6½	6½	6½	6½	52	52	50	10	10	11
Oldham	34	34	34	6	6	6	6	6	6	51½	51½	51½	9½	9½	9½
*a*Oxford	30	30	—	6	6	6	—	—	—	54	54	—	9¾	9¾	—
Plymouth	29	29	33	6	6	6	6	6	6¼	54	54	48	7	7½	8½
Portsmouth	27	32	—	6	6	6	6	6	6	54	54	—	8	8	8
Potteries	30	30	33	6	6	7	6½	6½	7	54	54	54	8	8	8
*a*Preston	31/6	—	33	6½	6½	6½	6½	6½	6½	54	—	53	9	—	10
Reading	26	26	—	6	6	7	—	—	—	56	56	—	6	6	—
Retford	28	28	—	—	6	7	—	—	—	54	54	—	7	7	—
*a*Rochdale	32	32	—	6½	6½	6½	—	—	—	54	52	—	9	—	—
*a*Scarborough	28	28	30	6	6½	7	—	—	—	52½	52½	52½	8	8	8
*a*Sheffield	33	33	36	6¼	6½	7	7½	7½	7½	51	51	50	9	9	10
*a*Shrewsbury	28	30	—	—	—	—	—	—	—	54	54	—	7	7	—
Southampton	24	26	28	5	5	5	5	5	5	54	54	54	6	6	6
Southport	34	34	34	7½	7½	8	8	8	8½	51	51	51	10	10	10
*a*Stafford	28	32	—	—	—	—	—	—	—	54	54	—	7	10	—
Stockport	32	32	32	6	6	6	6	6	6	54	54	54	8	8	8
Stockton	29	29	—	—	—	—	—	—	—	53	53	—	8	8	—
*a*Sunderland	33	33	38	6	6	6½	7½	7½	8	53	53	50	9	9	12
Swansea	28/6	28/6	28/6	6½	6½	6½	6½	6½	6½	54	54	54	8	8	8
Tunbridge Wells	26	26	—	5	5½	6	—	—	—	54	54	—	6	6	—
Wakefield	30	30	—	—	—	—	—	—	—	54	54	—	8	9	—
Walsall	32	32	—	6½	7	7½	—	—	—	54	54	—	9	9	—
Warwick and Leamington	26	26	—	5½	6	7	—	—	—	54	54	—	6	6	—
West Bromwich	30	30	—	6½	7	7½	—	—	—	54	54	—	8	8	—
Wigan	32	32	—	6½	6½	6½	—	—	—	52	52	—	8½	8½	—
*a*Wolverhampton	30/6	35	35	6	6½	7	6	6½	7	52	52	52	8	10	10
*a*Worcester	30	30	30	6	6	6½	6	6	6½	52½	54	54	7	7	7
*a*York	29	30	38	6¼	6¼	6½	7½	7½	7¾	54	54	54	8	9½	12
Other Societies—															
Aberdeen	30	30	39/6	5¾	5¾	6¼	7½	7½	8	51	51	51	10	10	12
Cork	32/6	32/6	32/6	—	—	—	—	—	—	53	53	—	9	9	9
*a*Dublin	35	—	—	7	7½	8¼	7½	8	8¾	54	54	—	10¾	—	—
*a*Dundee	30	32/6	42	6	6	6½	7½	7½	8	51	51	51	10	10½	13
*a*Edinburgh	32/6	32/6	40	6¼	6¼	6¾	7½	7½	8	52½	52½	51	10½	10½	12½
*a*Glasgow	34	34	40	7½	7½	8	8	8	8½	52½	52	51	12	12	12
*a*Greenock	34	—	34	—	—	—	7¼	7¼	7¼	52½	52½	52½	12	12	12
Lewes	30	—	—	6¼	6¼	6¼	—	—	—	60	60	—	—	—	—
Paisley	34	34	34	—	—	—	—	—	—	52½	52½	52½	12	12	12
Perth	30	30	—	—	—	—	—	—	—	51	51	—	10	10	—
Salisbury	28	30	—	6	6	6	—	—	—	56	56	—	6	6	—
Stirling	27	27	—	—	—	—	—	—	—	54	54	—	9	9	—
Waterford	24	24	—	—	—	—	—	—	—	55	55	—	8	8	—

(*a*) These Societies have peculiarities in their mode of payment which cannot be tabulated,

LINOTYPE COMPOSITION.

TOWNS.	Minimum 'Stab Wages.				Number of Hours Per Week.				Overtime Rate Per Hour.			Piece Scale per 1,000.	
	Morning.	Evening.	Weekly.	Jobbing.	Morning.	Evening.	Weekly.	Jobbing.	Morning.	Evening.	Weekly.	Night.	Day.
T. A. Branches—	*s.*	*s.*	*s.*	*s.*					*d.*	*d.*	*d.*	*d.*	*d.*
Accrington	—	—	38	—	—	—	48	—	—	—	12	—	2½
Barrow	—	—	31/6	—	—	—	54	—	—	—	9	—	2½
Bath	—	—	34	—	—	—	50	—	—	—	—	—	—
Belfast	45	40	40	—	50	54	54	—	18	12	12	3	2½
Birmingham	49	44	44	—	42	48	48	—	21	16½	16½	3½	3
Blackburn	—	40	40	—	—	48	48	—	—	12	12	—	2½
Bolton	—	40	40	—	—	48	48	—	—	13	12	—	2½
*Bradford	45	36	36	—	45	48	48	—	16	12	12	—	2½
Brighton	—	—	35	—	—	—	57	—	—	—	—	—	2½
Burnley	—	—	36	—	—	—	48	—	—	—	—	—	—
Carnarvon	—	—	—	—	42	—	48	—	—	—	—	3	2½
Chester	—	—	—	—	—	—	48	—	—	—	—	—	2½
Derby	45	37	35	35	42	48	48	51	10	9	8½	—	—
Enniskillen	34	—	—	—	56	—	—	—	—	—	—	—	—
Halifax	—	28	—	—	—	54	—	—	—	7½	—	—	—
Hartlepool	—	—	35	—	—	—	48	—	—	—	12	—	—
Hull	46	40	40	—	46	48	48	—	15	12½	12½	3	2½
Kendal	—	—	28	—	—	—	51	—	—	—	—	—	—
*Leeds	52	41	41	—	45	51	51	—	13	13	13	2½	2½
Leicester	42	40	40	35	42	48	48	52	18	12½	12½	—	—
Lincoln	—	34	34	—	—	48	48	—	—	10	10	—	—
Liverpool	52/6	52	—	—	42	48	—	—	22½	19½	—	3¾	3¼
Manchester and Salford	47/6	40	38/6	38/6	44	44	48	48	19½	16½	12	3½	3
Middlesbrough . .	—	36	36	—	—	48	48	—	—	12	12	—	—
Newcastle . . .	47/6	40	40	—	45	48	48	—	18½	15	15	—	—
Newport . . .	—	32	32	—	—	50	50	—	—	7½	7½	—	—
Northampton . .	—	35	35	—	—	50	50	—	—	10½	10½	—	—
Nottingham	43	39	39	39	48	48	48	48	13	12	12	—	—
Oldham	—	40	—	—	—	48	—	—	—	15	—	—	—
Oswestry	—	—	—	—	—	—	47½	—	—	—	—	—	2½
Oxford	—	—	40	—	—	—	48	—	—	—	—	—	—
Plymouth	40	34	—	—	45	48	—	—	—	—	—	2½	2½
Pontypridd	—	—	—	—	—	—	48	—	—	—	—	—	2½
Portsmouth	—	—	34	—	—	—	—	—	—	—	—	—	—
Potteries	—	38	—	—	—	48	—	—	—	12	—	—	2½
*Preston	—	38	38	—	—	48	48	—	—	12	12	—	2½
Rochdale	—	—	40	—	—	—	48	—	—	—	12	—	—
*Sheffield	47/6	40	40	—	45	48	48	—	18½	15	15	3	3
Southport	—	40	40	—	—	48	48	—	—	12	12	—	3
Stafford	—	—	35	—	—	—	—	—	—	—	—	—	2½
Stockport	44	40	—	—	44	48	—	—	14	12	—	3	2½
Sunderland	—	35	—	—	—	48	—	—	—	12	—	—	—
Swansea	—	35	—	—	—	48	—	—	—	8	—	—	—
Wakefield	—	—	30	—	—	—	48	—	—	—	—	—	—
Walsall	—	—	38	—	—	—	48	—	—	—	12	—	2¾
Wigan	—	—	40	—	—	—	48	—	—	—	15	—	—
Wolverhampton . .	—	40	40	38	—	48	48	48	—	12	12	—	—
Worcester	—	33	33	—	—	54	54	—	—	—	—	—	—

* In these Branches a graduated scale of night money is paid,

THE FOLLOWING NOTES REFER TO THE PRECEDING TABLES.

AYLESBURY.—London piece prices one-fourth off.

BOLTON.—Dailies are evening papers.

BRADFORD.—Overtime on jobbing, 9d. per hour to 10 P.M.; 11d. after. Daily news hands, 2d. per hour extra from noon to 12 P.M.; 3d. after.

CARDIFF.—Overtime after 10 P.M. 10d.; Sundays 1s.

CHESTER.—Overtime after 10 P.M. 9d.

DARLINGTON.—Daily paper hands 2d. per hour extra from 7 to 12 P.M.; 12 to 3, 3d.; after 3, 4d.

DERBY.—Overtime, time and a quarter up to 10 o'clock; time and a half up to ordinary time of commencing work; time and a half after 5 o'clock on Saturdays.

GUILDFORD.—Four-fifths London piece prices.

HUDDERSFIELD.—Daily papers carry same extras as at Bradford.

HULL.—Piece prices on evening papers 7d. all round. Overtime on the same papers is 10d. per hour; and the night shilling is paid to jobbing and weekly news men after 10 P.M.

LEICESTER.—Overtime after 10 P.M. 10½d.

MANCHESTER.—Day hands on daily papers 52 hours per week; overtime 10d. to 7 P.M., 1s. after.

NEWCASTLE.—Daily paper hands entitled to one week's holiday in the year. Overtime 9½d. to 10 P.M.; from 10 P.M. to 6 A.M., 10½d.; after 5 P.M. on Saturdays, 1s. 0½d.

OXFORD.—Overtime 2d. and 3d. per hour extra.

ROCHDALE.—Overtime 10d. after 10 P.M.

SCARBOROUGH.—Overtime 10d. after 12 P.M.

SHEFFIELD.—Overtime 3d. extra after 10 P.M.

SUNDERLAND.—Overtime 1s. after 12 P.M.

WOLVERHAMPTON.—Daily is an evening.

WORCESTER.—Dailies are evenings.

ABERDEEN.—8d. per hour waiting-time is paid piece hands on daily papers.

DUNDEE.—Evening paper piece prices ½d. more than weekly. Overtime 3d. extra.

EDINBURGH.—Overtime same as Dundee; waiting-time is paid as in Glasgow.

GLASGOW.—Brevier and Minion ½d. less per 1,000 for reprint on weeklies. Waiting-time, 1s. per hour on dailies on piece.

GREENOCK.—Daily paper rate applies to evening papers.

BELFAST.—Overtime after 10 P.M. 1s. per hour in weekly news and jobbing offices.

DUBLIN.—Overtime on jobbing and weekly news, 3d. to 11 P.M. and 6d. after.

⁂ These particulars have been compiled from statistics collected by the Typographical Association. The rate of overtime is difficult to give in a tabulated form, as several societies obtain increased rates after certain hours in the evening. Piece prices on daily papers are also in some offices increased by a fixed sum per hour for night work. The minimum recognised rate is made the standard of wages, and in many instances the average is higher than the sum stated. We have omitted several of the smaller towns, but a complete list can be obtained at the offices of the London Society of Compositors for 2d.

COLONIAL RATES OF WAGES.

ADELAIDE....	'Stab, £2 15s. per week of 48 hours.
(S.A.T.S.)...	Piece (jobbing or book), 1s. per 1,000, or 1s. 3d. per hour.
	,, ,, ,, night work, 1s. 1d. per 1,000, or 1s. 6d. per hour.
	,, (dailies), 1s. 1d. per 1,000; time work, 1s. 3d. per hour; 1s. 6d. night work.
	Overtime one-fourth extra.
BRISBANE....	'Stab, £2 12s. 6d. per week of 48 hours.
(Q.T.A.)	,, Overtime, up to 12 o'clock, 1s. 6d.; after 12 o'clock, 2s. per hour.
	,, Sunday, Christmas Day, and Good Friday, double.
	Piece, morning papers 1s. 1d. per 1,000; evening papers 1s.; overtime 3d. extra.
SYDNEY......	'Stab £3 per week of 48 hours.
(N.S.W.T.A.)	Piece (jobbing or book), 1s. per 1,000 day work, 1s. 1d. night work.
	,, morning papers 1s. 1d. per 1,000; evening papers 1s. 2d.
	Overtime, up to 12 o'clock, one-third extra; after 12, double.
	Sunday, Christmas Day, and Good Friday, double.
MELBOURNE.	'Stab, £2 16s. per week of 48 hours.
(A.T.U.) ...	Piece 1s. 1d. per 1,000.
	Overtime, up to 10 o'clock, 3d. extra; after that hour, 6d.
PERTH	'Stab, £2 2s. per week of 48 hours.
(W.A.)......	Overtime, 1s. 6d. per hour.
WELLINGTON	'Stab, £2 2s. to £3 per week of 48 hours.
(N.Z.T.A.) ..	Piece, 1s. to 1s. 1d. per 1,000.
	Overtime, 1s. 6d. to 1s. 9d. per hour; Sunday, double.

SOUTH AFRICA.	Hours.	1,000 ens.	'Stab.	Overtime.
CAPE COLONY—Capetown . . .	48	11d.	55s.	1s. 3d. per hr.
Wynberg . . .	52	..	45s.	1s. ,,
Port Elizabeth .	50	11d.	65s.	1s. 3d. ,,
Kimberley . . .	50	11d.	85s.	2s. ,,
East London . .	45 to 47	..	50s.	1s. 3d. ,,
Grahamstown . .	50	..	45s.	1s. ,,
Kingwilliamstown	48 to 50	.	45s. to 50s.	1s. 3d. ,,
NATAL—Maritzburg	48	11d.	57s. 6d.	1s. 6d. ,,
Durban	48	11½d.	57s. 6d.	1s. 6d. ,,
Newcastle	48	..	55s.	2s. ,,
TRANSVAAL—Pretoria	48	1s. 5d.	100s.	2s. 6d. ,,
Johannesburg . . .	48	1s. 4d.	100s.	..
ORANGE RIVER COLONY— Bloemfontein	48	1s.	80s.	.

It should be mentioned that, although fifty-six hours per week is the maximum working time on piece or 'stab, the local rules define when a day's work begins and ends (providing for the day preceding the publication of newspapers), without a proportionate advance for overtime and Sunday work. As already stated, no society is eligible for admission to the Typographical Association, and no man can be recognised as a member of that body, that accepts a 'stab of less than 24s. per week, or an equivalent piece scale. In the provinces, persons engaged on 'stab wages may be required to change to piece-work prices, or *vice versâ*, but at least a fortnight's notice must be given previous to such change.

The London Scale for Book and Jobbing Work.—The following is the text of the Scale of Prices, etc., for book and jobbing work, settled at the conference of employers and employed in 1891:—

SECTION I.—PRICES PER THOUSAND.

1.—All works in the English language, common matter, including English and Brevier, to be cast up at 7½d. per 1,000; Minion, 7¾d.; Nonpareil, 8½d.; Ruby, 9d.; Pearl, 9½d.; Diamond, 11½d.; head and white lines included. A thick space to be considered an en in the width, and an en to be reckoned an em in the length of the page. 1,000 to be charged where the number of letters amount to 500;

under 500 not to be reckoned. If the calculation per 1,000 shall not amount to an odd 3d., the odd pence to be suppressed in the price of the work; but where it amounts to or exceeds 3d., 6d. to be charged.

Reprints in every respect exact reproductions of the originals to be cast up at ¾d. per 1,000 less. Reprints not in every respect exact reproductions of the originals, which may be set in a different sized type and to a different measure, containing verbal corrections, simple alterations of style, and typographical alterations, to be cast up at ½d. per 1,000 less. Reprints with MS. insertions not exceeding one-eighth of the volume to be cast up at ¼d. per 1,000 less; and such reprints may be derived from various sources, although by the one author.

Thin founts to be cast at ¼d. per 1,000 extra for every en below 12 ems of their own body in thickness.

Bastard founts of one remove to be cast up to the depth and width of the two founts to which they belong; of two removes, to be cast up to the smaller body both in depth and width.

Matter stereotyped by the plaster process to be cast up, if with high spaces, at ¼d. per 1,000 extra; if with low spaces, at ½d. per 1,000; but should any other method be adopted entirely obviating the inconvenience occasioned, no extra charge per 1,000 to be made.

The price per 1,000 throughout to apply to solid matter; ¾d. per 1,000 to be deducted in all cases when 6-to-pica leads or upwards are used; when 8-to-pica are used for brevier or smaller bodies; and when 10-to-pica are used for pearl or smaller bodies; but no reduction to be made for leads thinner than 10-to-pica, or for pieced leads. Distinct portions of a work or publication which are uniformly leaded or solid to be so charged.

By the term "common matter" is understood the usual description of bookwork, but where any departure whatever is made by the introduction of peculiar matter, extraneous sorts, contractions, etc., the compositor to be entitled to an extra charge in accordance with the time occupied.

2.—Works printed in Great Primer to be cast up as English; in larger type than Great Primer, as half English and half Great Primer.

Section II.—FOREIGN LANGUAGES.

3.—Works in Foreign and the Welsh language, Roman type, including English and Brevier, to be cast up at 8½d. per 1,000; Minion, 9d.: Nonpareil, 9¾d.: Pearl, 10¾d.

4.—Greek without accents, Russian, Saxon, German, and similar languages in their own characters, to be cast up at 10¼d. per 1,000; with accents (whether cast on the body or not), 11¾d.

Dictionaries, and works in the Saxon language, in Roman type, with the two Saxon characters for *th*, to be cast up at an advance of ½d. per 1,000.

5.—Hebrew, Arabic, Syriac, and similar languages, to be paid double the price of common matter; if with points, to be cast up as a half body and half points doubled.

Works interspersed with Hebrew, or similar languages, in a different body to the text, to be paid 1s. per sheet extra for mixture of bodies.

6.—Greek, Hebrew, Saxon, and similar languages, if one word or not less than three separate letters, and not exceeding three lines in any one sheet, to be paid for that sheet 1s. extra; above three lines to be paid according to their value as cast up, with the addition of 1s. for placing each sheet in which they occur.

Section III.—DICTIONARIES AND GRAMMARS.

7.—English Dictionaries of every size, and works of a similar description, including English and Brevier, to be cast up at 8½d. per 1,000 when expressing only the meaning of words; 9d. per 1,000 when marked for pronunciation or accents.

8.—Gazetteers, Encyclopædias, Geographical Dictionaries, Dictionaries of Arts and Sciences, and works of a similar description, including English and Brevier, to be cast up at 8d. per 1,000.

9.—Dictionaries in two or more languages, of every size, including English and Brevier, to be cast up at 9½d. per 1,000.

10.—Grammars, Spelling Books, and works of a similar description, including English and Brevier, to be cast up at 8½d. per 1,000; if in a foreign or two languages, 9d. per 1,000.

Section IV.—FURNITURE.

11.—Works in Sixteens, Eighteens, Twenty-fours, or Thirty-twos, in Small Pica and upwards, to be paid 1s. 6d. per sheet extra; if in Long Primer, or smaller type, 1s. Forty-eights to be paid 2s. per sheet extra, and Sixty-fours, 2s. 6d.

Works imposed in small chases or with stereo furniture, to be charged 1s. per sheet extra on the above charges.

Small-sized folios, quartos, octavos, and works in Great Primer or larger type (English language) which do not come to 7s. when cast

up at the usual rate, including every item of charge, to be paid as follows: English and larger type, not less than 7s.; Pica, 8s. 6d.; English, 12mo, not less than 10s. 6d.; Pica, 11s. 6d.

In casting up no sheet to be considered single which exceeds 520 superficial inches of printed matter, including borders, rules, and inner margins; all of larger dimensions to be cast up as two single sheets of half the number of pages of which the whole sheet consists, *i.e.*, 4to as two sheets of folio, 8vo as two sheets of 4to. Works, although printed in half-sheets, to be cast up in sheets.

Section V.—PAMPHLETS, Etc.

12.—Pamphlets of five sheets and under to be paid 1s. per sheet extra. Parts of works done at different houses to be cast up according to the respective merits of the different parts; if consisting of a sheet or less, to be cast up according to Art. 19; if amounting to not more than five sheets, to be paid 1s. per sheet extra.

In a work of more than five sheets, where one-half is made up without a return of letter and leads, either of its own or of a similar work, 1s. per sheet extra to be paid upon the whole work; but in all instances it is to be distinctly understood that the letter and leads must be the same kind of letter, the same sized leads; if not, the charge for making up letter will stand good. If, however, the work be published in separate volumes, and the letter of the first volume be used for the second, or of the second for the third, no charge for making up letter to be made beyond the first volume.

Different volumes of the same work to be paid for distinctly according to their value.

Section VI.—BOTTOM NOTES.

13.—Bottom notes to be measured off and cast up to their own body, with an addition of 1s. for placing in folio, quarto, and octavo; 1s. 6d. in 12mo; 2s. in 16mo, 18mo, and above, for each sheet in which they occur.

Quotations, mottoes, contents to chapters, etc., in the same fount as the notes to be reckoned as notes.

In measuring off notes, quotations, etc., the actual quantity of small type to be reckoned, and when it exceeds one line, one line extra to be allowed for the white, but when there is only one line of small type, one line to be reckoned; *i.e.*, for each separate quantity of note, quotation, etc., exceeding one line, one line extra to

be reckoned for the space which separates it from the text, but where no space appears no line to be reckoned.

Types between the sizes of the text and the notes, or smaller, to be measured off and paid 1s. per sheet extra for placing in those sheets in which they occur, for every sized type used.

Double column notes, interspersed through a volume, to be charged, in addition to the price for notes, 1s. per sheet extra in 8vo; 1s. 6d. in 12mo; 2s. in 16mo.

Section VII.—SIDE NOTES.

14.—Side notes, not exceeding a broad quotation of five lines on an average in each page, to be paid, for each sheet in which they occur, 1s. in folio; 1s. 6d. in quarto; 2s. in octavo; 2s. 6d. in 12mo; 3s. in 16mo, 18mo, and above. Double-narrows, 1s. 6d. in folio, 2s. 6d. in quarto. Cut-in notes to be paid as side notes, with the addition of 2d. for each justification.

Side notes in nonpareil, though not exceeding the quantity specified, and not cast up to their value, to be paid 6d. per sheet additional; if in pearl, 1s. per sheet additional.

Where side notes exceed the maximum quantity specified, *viz.*, five lines on an average in each page, the actual number of lines set up to be counted and paid treble the price of common matter, as an equivalent for composing and making up. In casting up the actual width only of the text and side notes to be taken respectively.

Double side notes, or notes upon each side of the page, to be paid double the price specified for notes on one side of the page, for each sheet in which they occur.

Figures in the margin down the side of a page not to be considered side notes, but to be charged extra according to the trouble occasioned.

Under-runners not to be cast up with the side notes, but to be paid by agreement between the employer and journeyman.

Side notes attended with more than ordinary trouble to be paid by agreement between the employer and journeyman.

Section VIII.—CATALOGUES.

15.—Library Catalogues, in whatever language (Roman type), to be cast up at 8d. per 1,000; Booksellers' Catalogues at 9d. per 1,000; not including the numbering. Small type, or any other extra, to be paid as in bookwork.

16.—Auctioneers' Catalogues and Particulars (other than Catalogues of Books provided for by Art. 15) to be cast up at 7½d. per 1,000 solid, 7d. leaded. Small type, or any other extra, to be paid as in bookwork.

The "conditions" page, if standing, to be paid as a page of the catalogue; if composed, according to the type in which it is set.

Section IX.—REVIEWS, MAGAZINES, etc.

17.—Reviews, Magazines, and works of a similar description, consisting of more than one fount and cast up to the respective bodies, to be paid 2s. 6d. per sheet extra.

No deduction to be made for leads occasionally used, unless with sizes of type leaded throughout according to the plan of the publication.

Contents and other prefixed matter to a volume of a publication belong to the companionship who has done the parts, but such matter may by mutual arrangement be given to another piece companionship in an emergency.

Section X.—WRAPPERS.

18.—Wrappers may by mutual agreement between the employer and journeyman be set up either by piece or establishment hands; if by the latter, such wrappers belong to the house.

Standing advertisements, wood-cuts, or stereo blocks, in a wrapper or advertising sheet, not to be chargeable, except for the time occupied in making up.

Section XI.—JOB WORK.

19.—Jobs of one sheet or under to be cast up at 8½d. per 1,000; in foreign language, 10d. Jobs in smaller type than Brevier to take the proportionate advance specified in Art. 1.

Two pages only, irrespective of imposition, to be paid as two pages; if with an indorse or any other kind of matter constituting a third, then as three pages.

Jobs of the character of bookwork to be cast up in sheets, with the usual extras, and the portion of the sheet which is actually set up or imposed to be charged.

Tracts or papers of one sheet or under, forming part of a uniform series, not to be considered jobs, but to be cast up according to Art. 1, with the addition of 1s. per sheet for folio, 1s. 6d. for 4to, and 2s. 6d. for 8vo and smaller sizes, provided the compositors obtain a return of letter, etc., in each case.

20.—Where works are printed on alternate pages, the compositor to be entitled to charge for the time occupied in making up the blanks.

21.—Undisplayed broadsides in one measure, such as leases, deeds, and charter-parties, above the dimensions of crown, whether table or common matter, to be paid double the price of common matter; on crown and under, one and one-half common matter; if set in 2, 3, or 4 columns, one and one-fourth common matter; 5 columns, one and one-half; 6 columns, double. The indorse to be paid one-fourth of the inside page as common matter. Displayed broadsides, if containing more than 16 lines, to be paid as follows:—

	s.	*d.*
Foolscap or Crown	5	0
Demy	7	0
Royal	8	6
Double Crown	10	0

If containing 13 and not more than 16 lines, three-fourths of the prices specified; if 12 lines and under, one-half.

Broadside descriptions of plates to be paid one and one-fourth common matter, and each turn-over page to be paid as a full page.

Section XII.—TABULAR AND TABLE WORK.

22.—Tabular and table work is matter set up in three or more columns depending upon each other and reading across the page. To be paid as follows:—

3 columns without headings, one-fourth extra.

3 columns with headings, 4 columns without, one-half extra.

4 columns with headings, and 5 or more with or without, double the price of common matter.

Headings in smaller type than the body, but not exceeding two removes, if not more than three lines in depth, to be paid 1s. extra; if more than three lines, or if in smaller type than two removes, to be cast up according to the relative values of the two bodies, the greatest number of appearing lines being considered the depth.

The following to be considered a definition of the word heading:—

Parish.	Name of Voter.	Residence.
Chelsea . .	John Smith . .	Belgrave Place.

Or thus, when set in smaller type, and forming three or more lines :—

Name of Voter.	Trade or Profession.	Place of Residence.
John Smith . . .	Wheelwright . . .	Chelsea.

Blank tables to be cast up double the price of the text type of the work. No extra charge to be made for headings in smaller type, unless such headings constitute one-third of the table.

The extra price for table, tabular, and column matter to be paid on the actual dimensions only, with the following exceptions: Title headings to table and tabular matter to be reckoned as part of such matter, but when exceeding 5 ems of the body of the table, etc., in depth, 5 ems only to be charged as table, the remainder as common matter.

Bottom notes to tables to be paid on the same plan as title headings; not to constitute a *pro ratâ* charge per sheet, provided they do not exceed 5 ems of the body of the table.

Table, tabular, and column matter, when paid by an addition to the price per 1,000, to be cast up according to Art. 1 : thus a Greek table is cast up as once Greek and once English.

Tables belonging to a work to take the extras of that work.

Section XIII.—COLUMN WORK.

23.—Column matter, as distinguished from table and tabular, is matter made up continuously in two or more columns, not depending upon each other, and reading down the page. To be paid as follows :—

2 columns :—

In folio and 4to	1s. 0d. per sheet.
In 8vo	2s. 0d. ,, ,,
In 12mo	3s. 0d. ,, ,,
In 16mo and smaller sizes . .	4s. 0d, ,, ,,

3 columns :—

In folio and 4to, 2s. per sheet.

In 8vo and smaller sizes, one-fourth more than common matter.

4 columns :—

In folio and 4to, 4s. per sheet.

In 8vo and smaller sizes, one-half more than common matter.

5 *columns*:—

In folio and 4to, one-half more than common matter.

In 8vo and smaller sizes, double the price of common matter.

6 *columns*:—

In all cases double the price of common matter.

Column matter not exceeding 5 ems pica in width to be paid one-half more than common matter; not exceeding 4 ems pica, double the price of common matter.

Parallel matter, dialogues, vocabularies, comparative statements, and matter of a similar description, although arranged in columns depending upon each other, to be considered as column matter; if attended with extra trouble, to be paid by agreement between the employer and journeyman.

Two-column matter, interspersed through a volume, to be charged 1s. per sheet extra in 8vo, 1s. 6d. in 12mo, 2s. in 16mo, on the sheets in which such matter occurs.

Three columns depending upon each other, when made up forming six across the page; and six columns, depending upon each other, across two pages, to be charged double.

The foregoing charges to be made upon every description of work, and to include the insertion of column rules when required.

Section XIV.—ALGEBRAICAL WORK.

24.—Algebraical and mathematical works, consisting of mathematical fractional workings numerously interspersed throughout, to be paid double the price of common matter.

Where lines or small portions of algebraical or mathematical workings occur in different parts of a work, such lines or portions are not to be measured and cast up, but to be paid for in proportion to the labour or time employed in executing them.

Chemical and medical works to be cast up as common matter, with such extras for split fractions, superiors, inferiors, signs, etc., as shall be mutually agreed upon between the employer and journeyman for the time occupied.

Section XV.—PEDIGREES.

25.—Pedigrees to be paid double the price of common matter; and the heads and notes upon the same principle as the heads and notes of tables.

Pedigrees worked separately to take the extras of the work.

Section XVI.—INTERLINEAR MATTER.

26.—Interlinear matter, on the plan of the Hamilton system, to be paid as one-half the large and one-half the small type, and to be cast up as one and one-half the price of common matter.

In grammars, etc., where figures and words are arranged between the lines (not being a literal translation), one-fourth more than common matter to be paid.

Section XVII.—SLIP MATTER.

27.—Works set up in slips may be paid for in either of the following ways :—

a. To be cast up and charged at 8d. per 1,000 leaded or solid, with all such extras as may actually occur in the slips, the compositor to be relieved from all further responsibility. Matter set to less than 16 ems of its own body in width (not being table, tabular, or column matter) to be charged one-fourth extra; less than 10 ems of its own body, one-third extra. Slips so charged to become the property of the employer, who shall not be liable to any further claim, anything otherwise stated in the Scale notwithstanding; the copy to be given out and proofs pulled by the house.

b. Works sent out in slips, not in perfect pages, to be corrected and made up at the expense of the employer, and charged as sent to press; but if in two or three columns, provided that each column exceeds 12 ems pica in width, no charge for column matter to be made; if set in Long Primer or smaller type, the charges for 16mo, 18mo, etc., under Art. 11, to be relinquished; if sent out without headlines, the value of the headlines to be deducted.

Matter driven out by insertions to be charged by the compositor as the work goes to press, but the value to be deducted from the time taken in setting insertions and driving out such matter; when driven out by leads, the overmatter to be charged by the compositor, the time occupied in inserting leads to be deducted; when driven out by the insertion of woodcuts, the matter to be charged, but the time taken in justifying such woodcuts to be deducted.

Section XVIII.—MISCELLANEOUS.

28.—Indices, though but one measure, to be paid 2s. per sheet extra.

29.—Appendices, portions of works, etc., set up in a different type from the text, and made up in separate pages, to be cast up on their

own merits; and if not exceeding five sheets, or if made up without a return of letter, to take 1s. per sheet extra, according to Art. 12. Prefatory matter, preliminary dissertations, biographical memoirs, etc., not exceeding a sheet, if set up in type not less than the body of the text, to be paid as pages of the work; if set up in smaller type, to be cast up with the addition of the extras of the work; but if either exceed a sheet, to be cast up as appendices. Half-titles, titles, dedications, etc., in all cases to be paid as pages of the work. Indices, being provided for by Art. 28, are not included in this rule. Compositors engaged on a volume to be entitled to the preliminary, appendix, index, etc., but such matter may by mutual arrangement be given to another piece companionship in an emergency.

30.—Matter having been once used becomes the property of the employer at whatever time lifted, the compositor to be entitled to charge for correcting, making up, etc.

31.—Works, other than reviews or periodicals, in which more than one type is used in various parts of the text, to be charged 1s. for every fount above one for the sheets in which the mixture occurs.

32.—Works with rules or borders round the pages to be cast up to the actual dimensions of the type, an extra price being paid for the trouble occasioned.

33.—Blank pages to be filled up at the option of the author, the compositor to be entitled to charge for making up the blanks.

34.—Specimen pages in all cases to be paid as jobs.

35.—Cancels to be paid as pages of the work, with all extras.

36.—No deduction to be made for woodcuts, when constituting one-eighth of a volume or less; when exceeding that quantity the mode of charging to be arranged between the employer and journeyman. Run-in woodcuts to be paid not less than 2d. each extra.

37.—Compositors to be entitled to the author's proofs of all works they have composed, except when paid for in slip, in accordance with Art. 27, clause (*a*); but such proofs may by mutual arrangement be given to another companionship in an emergency.

38.—Corrections and time-work to be paid at the rate of 8½d. per hour.

39.—All works to be cast up as sent to press, except when paid for in slip, in accordance with Art. 27, clause *a*.

40.—Turned letters, when ordered to be used, to be altered at the expense of the employer.

41.—Clarendon, or other fancy type, to be paid not less than 1s. per sheet for each fount in such sheets in which it is used.

42.—Hair-spaced headlines to be charged 1s. per sheet extra in

8vo, 1s. 6d. in 12mo, and 2s. in 16mo ; headlines requiring justification to be paid at the same rates. Hair-spaced words introduced into the body of a work to be paid according to the time occupied. Brass rules after headlines, or used continuously throughout the sheet, if cut by the compositor, to be paid 1s. per sheet extra.

43.—Braces and justifications, letters or words of a smaller or larger size than the depth of the line in which they occur, requiring justification, inferior or superior letters, or figures made up of two pieces, and split fractions, to be paid according to the time occupied, but not less than 6d. per sheet for those sheets in which they occur.

44.—Initial or ornamental letters to be paid, if justified, in solid matter, 1d. ; in leaded matter, 2d. Cut-in initials to be paid not less than 1d. extra on the above charges.

45.—In all works where the last word of a line is taken into the line above or below, the compositor to charge at the rate of one full line for every four words, or portion thereof, taken above or below.

46.—Matter overrun to be paid one-half of the measure to which it is overrun, with all the extras ; this charge to include making up and imposition.

47.—Matter set to less than 16 ems of its own body in width (not being table, tabular, or column matter) to be charged one-fourth extra ; less than 10 ems of its own body, one-third extra.

48.—Music to be paid by agreement between the employer and journeyman.

49.—Suitable distribution for each work to be provided, but if matter interspersed with clarendon, italic, figures, etc., be given out, an arrangement to be made between the employer and journeyman whereby the latter may be compensated for the extra time occupied.

50.—Compositors not to be called on to clear away any description of work at their own expense.

By mutual arrangement between the employer and journeyman, and with the approval of the Chapel, compositors fifty-five years of age and upwards may accept employment at the minimum rate of 30s. per week, provided that they are regularly engaged in clearing away and not called upon, under any circumstances, to assist at case or to take up any description of composition, etc. The ordinary extra rates for overtime to be paid to compositors so engaged.

51.—By mutual arrangement between the employer and journeyman, piece companionships to have the right of appointing and controlling their own clickers, who must not be establishment hands.

Section XIX.—ESTABLISHMENT.

52.—Compositors not to be called off the piece on to the establishment for any description of composition, unless engaged for at least a fortnight, except with the consent of the Chapel, when they may assist in a case of emergency.

53.—Compositors not to contract, by way of farming, to do any description of bookwork or jobbing, or to accept an engagement on any such work so contracted for.

54.—Compositors called in to assist in the composition of bookwork or jobbing may take a casual engagement for not less than a day on the establishment, but not of greater length than a fortnight, without being entitled to a fortnight's notice, except when specifically engaged for a particular job and retained for that job only, in which case the engagement can be terminated on its completion, without notice.

55.—Compositors on the establishment to receive not less than 38s. per week of fifty-four hours, the apportionment of hours to be mutually agreed upon between the employer and journeyman in each office, and to govern all the compositors employed.

56.—Compositors, whether piece or establishment hands, if retained beyond a fortnight, to receive and give a fortnight's notice prior to their engagements being terminated.

Section XX.—OVERTIME.

57.—Overtime to be paid at the rate of 3½d. per hour extra for the first three hours; after that time, but in any case after 10 o'clock from Monday to Friday inclusive, at 4d. per hour till 12 o'clock, after that at 5d. per hour. On Saturday, for the first three hours, 4d. an hour, and after that time 5d. The charge for overtime to be governed by the ordinary working hours of each office, and to commence in any case before 8 A.M., after 8 P.M., and after 2 P.M. on Saturday, each day standing on its own merits. Compositors called upon to work the whole of the dinner hour to receive 4d. extra. Compositors regularly employed in a night companionship for a fortnight at least, to charge 3½d. per hour extra, including mealtimes. Compositors called upon to work overtime for more than three consecutive hours to be entitled to half-an-hour for refreshment after each three hours of overtime have been worked. Fractions of hours to be paid as complete hours. Lost time to be deducted at the ordinary rate, but a compositor coming in more than half-an-hour late may be called upon to work the first hour of overtime the

same day without charging extra, each day standing on its own merits.

58.—Sunday work to be paid at the rate of 8d. per hour extra from 12 o'clock on Saturday night to 8 o'clock on Sunday morning, when such work is continuous; compositors in no case to receive less than 3s. 4d. extra. The same rule to apply to Christmas Day. Compositors called in at 12 o'clock on Sunday night to be paid at the same rate; if at 6 o'clock on Monday or any other morning, except Sunday, at 4d. per hour extra.

Section XXI.—PARLIAMENTARY WORK.

59.—All work for either House of Parliament, such as public and private bills, minutes of evidence, reports of royal commissions of inquiry, etc., whether manuscript or reprint, leaded or solid, to be charged 7d. per 1,000, including English and Brevier; and to be cast up to the type used. Work for either House of Parliament, divided into two columns, to be charged 8d. per 1,000. Tables to be charged 1s. 2d. per 1,000. Foreign to be charged extra on the basis of the Book Scale.

60.—Pages consisting of two or three columns with one or more headings, or three or four columns without headings, to be charged as tabular, or one and one-half common matter.

61.—Pages consisting of four or more columns with one or more headings, or five or more columns without headings, to be charged as table, or double the price of common matter.

62.—Short pages occurring in a series of tables to be charged as full pages; but a table or piece of table occurring in a report, etc., to be charged only the depth of the table, measuring from the head to the conclusion of such table. The same rule to apply to tabular.

63.—In a series of tables all portions of pages left blank to be charged as table; in jobs or works consisting of common matter, where table or tabular matter is introduced, whatever blank occurs to be charged as common matter, unless the table or tabular matter forms more than three-fourths of the page; in which latter case the page to be charged a full page table or tabular, as the case may be.

64.—Headings to table or tabular matter, when in smaller type than the body of the table, to be charged extra.

65.—Pages consisting of four or five blank columns to be charged tabular; six or more, table; cast up to the size of type used in the bill, report, etc., in which they occur.

66.—Blank forms, when used by themselves, detached from any

bill, etc., to be charged as pica table or tabular according to the number of columns.

67.—Plain matter divided into two columns to be charged not less than 1s. per sheet extra.

68.—Read-over pages (as in Dr. and Cr. accounts of two pages), where one page only is tabular or table, the same charge to be made for both pages; read-over pages in no case to be charged less than tabular.

69.—The charge for side notes on Parliamentary Bills to be 3s. per sheet of four pages on broad quotations; 4s. on double-narrow quotations. For other descriptions of Parliamentary work, side notes of broad quotations, not exceeding five lines per page, to be charged 1s. 6d. per sheet in folio, 3s. in quarto; in double-narrows, not exceeding five lines per page, 2s. per sheet in folio, 4s. in quarto; all above that proportion to be paid *ad valorem* throughout a bill, report, appendix, etc. Double side notes to be charged double the above.

70.—Reports, minutes of evidence, and appendices to be cast up separately, and to take only the extras which strictly belong to them. Thus, if a report, etc., have side notes, and the appendix is without side notes, no charge is to be made on the appendix for side notes.

71.—Where two bottom notes, or one note of twenty lines, occur in a bill, report, appendix, etc., a charge of 1s. per sheet extra to be made throughout such bill, etc.; all above to be charged according to value.

72.—Work not intended for either House of Parliament, but executed for the public departments, to be charged according to the Book Scale, with all the extras.

Section XXII.—CHANCERY CASES.

73.—Bills and claims in Chancery, briefs for counsel, and all work for either of the Courts, to be charged in all respects according to the Parliamentary Scale.

Section XXIII.—APPEAL CASES.

74.—Appeal cases to be cast up at 8d. per 1,000; if above 40 ems pica in width, at 9d. per 1,000. Side notes, whether light or heavy, to be paid per sheet of 4 pp. folio, if on broad quotations, 3s.; double narrow, 5s.; double broad, 6s.; in quarto, on broad quotations, 4s. 6d.; double narrow, 7s. 6d.; double broad, 9s.

ABSTRACT OF THE LONDON SCALE OF PRICES FOR BOOK WORK, 1891.

MANUSCRIPT.

PER THOUSAND ENS.		COMMON.	FOREIGN.	DICTIONARIES.			GRAMMARS.		CATALOGUES.			GREEK.	
				English.		Foreign.	English.	Foreign.	Library.	Booksellers'.	Auctioneers'.	Without Accents.	With Accents.
		d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
English to Brevier	*leaded*	6¾	7¾	7¾	8¼	8¾	7¾	8¼	7¼	8¼	7	9½	11
	solid	7½	8½	8½	9	9½	8½	9	8	9	7½	10¼	11¾
Minion	*leaded*	7	8¼	8	8½	9	8	8½	7½	8½	7¼		
	solid	7¾	9	8¾	9¼	9¾	8¾	9¼	8¼	9¼	7¾		
Nonpareil	*leaded*	7¾	9	8¾	9¼	9¾	8¾	9¼	8¼	9¼	8		
	solid	8½	9¾	9½	10	10½	9½	10	9	10	8½		
Ruby	*leaded*	8¼	9½	9¼	9¾	10¼	9¼	9¾	8¾	9¾	8½		
	solid	9	10¼	10	10½	11	10	10½	9½	10½	9		
Pearl	*leaded*	8¾	10	9¾	10¼	10¾	9¾	10¼	9¼	10¼	9		
	solid	9½	10¾	10½	11	11½	10½	11	10	11	9½		
Diamond	*leaded*	10¾	12	11¾	12¼	12¾	11¾	12¼	11¼	12¼	11		
	solid	11½	12¾	12½	13	13½	12½	13	12	13	11½		

REPRINT. English to Brevier	leaded	6	7	7	7½	8	7	7½	6½	7½	6¼	8¾	10¼
	solid	6¾	7¾	7¾	8¼	8¾	7¾	8¼	7¼	8¼	6¾	9½	11
Minion	leaded	6¼	7½	7¼	7¾	8¼	7¼	7¾	6¾	7¾	6½		
	solid	7	8¼	8	8½	9	8	8½	7½	8½	7		
Nonpareil	leaded	7	8¼	8	8½	9	8	8½	7½	8½	7¼		
	solid	7¾	9	8¾	9¼	9¾	8¾	9¼	8¼	9¼	7¾		
Ruby	leaded	7½	8¾	8½	9	9½	8½	9	8	9	7¾		
	solid	8¼	9½	9¼	9¾	10¼	9¼	9¾	8¾	9¾	8¼		
Pearl	leaded	8	9¼	9	9½	10	9	9½	8½	9½	8¼		
	solid	8¾	10	9¾	10¼	10¾	9¾	10¼	9¼	10¼	8¾		
Diamond	leaded	10	11¼	11	11½	12	11	11½	10½	11½	10¼		
	solid	10¾	12	11¾	12¼	12¾	11¾	12¼	11¼	12¼	10¾		

Reprints not in every case exact reproductions of the originals are cast up ¼*d*. per 1,000 extra; reprints with MS. insertions, ½*d*. per 1,000 extra.

Stereotyped matter with high spaces is cast up ¼*d*. per 1,000 extra; stereotyped matter with low spaces is cast up ½*d*. per 1,000 extra.

Thin founts are cast up ¼*d*. per 1,000 extra for every en below 12 ems of their own body.

Bastard founts of one remove are cast up to the depth and width of the two founts.

Schedule for Lost Time and Overtime—Book and News.

Amount per week.			Rate per hour.	Lost time per hour. ¼	½	¾	Overtime 3½d. per hour.		Overtime 4d. per hour.		Overtime 5d. per hour.	
£	s.	d.	d.	d.	d.	d.	s.	d.	s.	d.	s.	d.
1	18	0	8½	2	4	6	1	0	1	0½	1	1½
2	0	0	9	2	4½	6½	1	0½	1	1	1	2
2	2	0	9½	2½	4½	7	1	1	1	1½	1	2½
2	4	0	9¾	2½	5	7	1	1½	1	1¾	1	2¾
2	5	0	10	2½	5	7½	1	1½	1	2	1	3
2	6	0	10¼	2½	5	7½	1	1¾	1	2¼	1	3¼
2	8	0	10¾	2½	5½	8	1	2½	1	2¾	1	3¾
2	10	0	11¼	3	6	9	1	2¾	1	3¼	1	4¼

The above schedule for lost time is not intended to interfere with rules governing each office.

In the event of any question arising whereon either the Book or News Scale is silent or not clearly defined, such question shall be governed by the custom of the trade (if any) or decided by mutual agreement; it being understood that for work of an exceptional character the compositor is entitled to charge such special rates as will adequately remunerate him for the time occupied on the work.

INDEX TO BOOK SCALE.

News Work—London Scale.—The following was settled at the Conference in 1891 as the London scale for News work composed by hand:—

I.—All newspapers, or publications partaking of the character of newspapers, composed in London, to be charged according to the following scale of prices:—

DESCRIPTION OF PAPER.	Per 1,000 en quads [1] of own body.[2]							Salaries of Establishment hands.	Per Galley.	Per Hour.
	Minion and larger sizes.	Minion Nonpareil.	Emerald.	Nonpareil.	Ruby.	Pearl.	Diamond.			
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	£ *s.* *d.*	*s.* *d.*	*d.*
Morning . .	9	9½	9½	10	10½	11	13	. .	3 10	11½
Evening . .	8½	9	9	9½	10	10½	12½	. .	3 7	{ 11 10½
Weekly and wider periods	8½	9	9	9½	10	10½	12½	1 18 0	3 7	10

[1] A thick space to be reckoned an en in the width. As the price per 1,000 is clearly established, the compositor should set up neither more nor less than just such a number of lines to the galley as will amount to 3s. 10d. on morning, or 3s. 7d. on evening and weekly papers.

[2] Depth of Type:—

English . .	64 lines to a foot.	Minion . . .	122 lines to a foot.
Pica	71½ ,,	Emerald . .	128 ,,
Small Pica .	83 ,,	Nonpareil . .	143 ,,
Long Primer .	90 ,,	Ruby . . .	166 ,,
Bourgeois . .	102 ,,	Pearl . . .	180 ,,
Brevier . . .	110 ,,	Diamond . .	204 ,,

In founts below minion, when the type comes under the above standard, an advance of price is granted if it is equal to or exceeds half the difference between the larger fount and the next smaller one, but under that proportion no extra charge is made. Thus, when a bastard nonpareil contains half as many more ems to the foot as the difference between nonpareil and ruby, a farthing extra is charged, but if under that proportion no charge is made. In every instance the founts are cast up to their own ems. One farthing extra to be paid on all founts for every en below 12 ems of their own body in thickness.

II.—DAILY PAPERS.

Engagements on daily papers are of two kinds, *viz.*:—

1.—Regular hands, secured one galley per day, and as much in addition as the requirements of the paper will admit of.

2.—Assistants, secured one galley on morning, and half a galley on evening papers, each time of working.

III.—MORNING PAPERS.

3.—Regular hands are engaged (by the fortnight) to do at least one galley per night, and as much more as the requirements of the paper will admit of; the galley reckoned as four hours' work, including corrections. To correct as nearly as possible the amount of their composition. Should the printer be unable to furnish copy according to the above specification, at the rate of one quarter per hour is to be charged from the time of taking copy until the finish.

4.—Assistants are not under any regular engagement, but are entitled to a galley, and must be furnished at the rate of a quarter per hour from the time of taking copy. Assistants employed by the property at a galley per night are entitled to a fortnight's notice.

5.—Time work to be paid at not less than 11½d. per hour.

6.—Matter composed after the paper has gone to press, when making less than a galley, to be corrected by the property.

7.—Threepence per hour, or part of an hour, to be paid as overtime for all extra editions upon morning papers.

8.—Special Sunday work to be paid for at the rate of 6d. per hour extra, but a compositor in no case to charge less than 2s. 6d. extra.

IV.—EVENING PAPERS.

9.—Regular hands to be guided by the same rules as laid down for those on morning papers, claiming a galley or charging the same, at the completion of the first ordinary edition.

10.—No "cut" between editions to be of greater length than half an hour, except the dinner hour.

11.—The working day to be nine hours, exclusive of all "cuts," which shall not exceed one hour and a half, on the completion of which the compositor to be entitled to charge 3d. extra for each additional hour, or part of an hour, that he is required to remain in the office; but in any case 3d. extra per hour to be charged before 7 A.M. or after 8 P.M.

12.—Sunday work to be charged at the rate of 6d. per hour extra from 12 o'clock on Saturday night to 12 o'clock on Sunday night; but a compositor in no case to charge less than 2s. 6d. extra.

13.—Every odd quarter, or hour of time work, to carry the charge of 11d. Thus the first quarter, or hour, would be 11d., the second 10½d., the third 11d., and the fourth 10½d.; making the four quarters, or hours, 3s. 7d.

14.—Compositors (not forming a portion of the regular companionship) called in, or ordered to attend, after copy has been taken, to assist on the first edition of an evening paper, are entitled to not less than half a galley.

V.—MORNING AND EVENING PAPERS.

15.—Not less than one hour to be charged on time; but the fractional parts of an hour beyond that period to be charged at their value in lines.

16.—Extra editions are done on time or lines, at the option of the printer. If on time, only the rate of a quarter per hour is produced. If on lines, and there be not a sufficient supply of copy, the rate of a quarter per hour is charged. No charge less than a quarter. Each edition is a separate charge, unless several editions are going on continuously, in which case time or lines is charged from the commencement till the finish of these editions. On morning papers an extra quarter is allowed to persons called in to assist, if the quantity composed be less than a galley.

[On extra editions, when the compositor is required to "pull out" (that is, to compose more than a quarter per hour), the general practice is to charge the lines so composed. Thus, compositors detained for three hours for an extra edition, and then ordered to "pull out" for another hour, during which time they might compose half a galley, would charge a galley and a quarter, instead of only the four hours they are engaged.]

17.—All composition or corrections in hand when the paper goes to press must either be suspended or charged as a second edition—that is, charging not less than a quarter of a galley.

18.—On daily papers, matter composed before the usual time of commencing work, such as leading articles for editors, advertisements as copy for other papers, etc., to be charged distinct from the day's work. If less than a quarter, a quarter to be charged; if more, the number of lines.

19.—Assistants, if ordered to attend at the ordinary time of taking copy, to be entitled to the charge of a galley; but if holding a *bonâ-fide* employment by the property, and taken from other work when their services are required, to be entitled to not less than a quarter for each time of being called on.

20.—No apprentices to be employed on daily papers, morning or evening.

21.—Declaring on time on daily papers is contrary to Scale.

VI.—TRI-WEEKLY AND BI-WEEKLY PAPERS.

22.—Tri-weekly and bi-weekly papers to be considered weekly; but in all cases of papers published oftener than three times a week, the mode of producing which is similar to that of daily papers, the same to be paid for in accordance with the daily paper scale.

VII.—WEEKLY PAPERS.

23.—Publications containing news of any description, and produced by the ordinary method of weekly newspapers, to be paid accordingly. Commercial prices current, shipping lists, and similar publications not necessarily to be considered newspapers.

24.—Extra editions to be done on time or lines, at the option of the printer. If on time, only the rate of a quarter per hour to be produced; if on lines, and there be an insufficient supply of copy, the rate of a quarter per hour to be charged. No charge to be less than a quarter, and each edition to be a separate charge.

25.—Compositors, not already employed in a house, called in to assist are entitled to charge not less than eight hours if employed on time, or less than a galley if paid by lines, claiming a galley, or charging the same, at the expiration of four hours from the time of taking copy. Compositors regularly employed in a house where a weekly paper is done, if required to leave their ordinary work to assist on the paper, are entitled to not less than a quarter of a galley, or an hour, for each time of being called on, but not to correct their matter unless they compose a galley.

26.—No deduction to be made for letter when the composition is under a galley, but when it exceeds a galley, the letter to be either deducted for or returned, at the option of the compositor.

27.—Compositors not to be called off the piece to compose on time.

28.—'Stab hands and apprentices, when engaged on the line, to lift copy fairly and in regular order, and pull, slate, and cut with the piece hands. This rule not necessarily to apply to advertisements, nor to articles given out in their entirety to apprentices who have served less than three years of their time; but no particular article or portion thereof shall be given to apprentices while the line is on because of the profitable nature of such article.

29.—Time work to be paid at the rate of not less than 10d. per hour, subject to the extra for overtime.

30.—Compositors on the establishment to receive not less than 38s. per week of 54 hours, the apportionment of hours to be mutually agreed upon between the employer and journeyman in each office, and to govern all the compositors employed.

31.—Overtime to be paid at the rate of 3½d. per hour extra for the first three hours; after that time, but in any case after 10 o'clock from Monday to Friday inclusive, at 4d. per hour till 12 o'clock, after that at 5d. per hour. On Saturday for the first three hours 4d. per hour, and after that time 5d. The charge for overtime to be governed by the ordinary working hours of each office, and to commence in any case before 8 A.M., after 8 P.M., and after 2 P.M. on Saturday (except in the case of weekly newspapers the getting out of which regularly enters into Sunday morning and produced in offices where no other description of work is done, when the charge of 5d. per hour extra shall commence not later than 8 p.m. on Saturday for grass hands, and not later than 12 o'clock (midnight) for establishment hands, provided that in the case of the latter a regular weekly holiday in lieu of Saturday is mutually agreed to between the employer and journeyman), each day standing on its own merits. Compositors called upon to work the whole of the dinner hour to receive 4d. extra. Compositors called upon to work overtime for more than three consecutive hours to be entitled to half-an-hour for refreshment after each three hours of overtime have been worked. Fractions of hours to be paid as complete hours. Lost time to be deducted at the ordinary rate, but a regular hand coming in more than half-an-hour late may be called upon to work the first hour of overtime the same day without charging extra, each day standing on its own merits.

32.—Special Sunday work, performed after the ordinary and regular edition or editions of a paper have been sent to press, to be paid at the rate of 8d. per hour extra, from 12 o'clock on Saturday night to 8 o'clock on Monday morning, when such work is continuous; compositors in no case to receive less than 3s. 4d. extra. The same rule to apply for special work on Christmas Day. Compositors called

in at 12 o'clock on Sunday night to be paid at the same rate; if at 6 o'clock on Monday or any other morning except Sunday, at 4d. per hour extra.

33.—Compositors, whether piece or establishment hands, if retained beyond a fortnight, to receive and give a fortnight's notice prior to their engagements being terminated.

VIII.—DAILY AND WEEKLY PAPERS.

34.—Not more than three slips to be pulled of each galley, including the revise. If more than three are required, lines to be charged equivalent to the trouble, but not less than three lines to be charged.

35.—No compositor to be called upon to pull less than half a galley of fresh matter; nor shall a compositor be expected to seek for a galley wherein to insert fresh matter, without being entitled to charge three lines for the trouble occasioned.

36.—All leads other than those used in making up to be charged by the compositor.

37.—Bastard founts of one remove to be cast up to the depth and width of the two founts to which they belong; of two removes, to be cast up to the smaller body, both in depth and width.

38.—Matter having been once used becomes the property of the employer, at whatever time lifted.

39.—Matter with head or first lines larger than the body to be charged according to the depth of the body of the taking; but all rules to be charged as distinct lines, except advertisement rules, which in all cases are to be counted with the first line, as two lines only.

40.—General heads of articles, and the rules after, whether standing or not; rules in the middle or at the end of articles; and blocks inserted by the compositor to be charged.

41.—Brass or other clump heads to sections, woodcuts, etc., placed on the galley or in the forme by the printer or his time hands, are the property of the employer.

42.—Greek, etc., to be left blank, or paid for according to value, not less than 1s. to be charged.

43.—Newspapers in a foreign language to take the same advance as bookwork. Portions of newspapers in foreign languages to take the charge of one-fourth extra.

44.—Supplements to be charged according to the scale for the paper to which they are attached.

45.—Alterations from copy in first proofs, if done by the compositor correcting such proofs, to be charged according to the time occupied, not less than three lines to be charged.

46.—Not less than three lines to be considered a taking; if less, three lines to be charged.

47.—Compositors not to be called on to clear away any newspaper work.

48.—Matter consisting of subscribers' names, with sums of money run out to the end of the line; names of horses, with age, stone, lb. run out; measurements of land, and all composition of the same description, to take no extra charge; but when there are two columns of such figures brought into the same width, one-third extra to be charged; three columns, one-half extra; four or more columns, double. Other matter which requires casting off for the purpose of ascertaining proper widths for the purpose of ranging, whether such matter consists of words or figures, each width of ranging to be considered a column. In matter other than the exceptions given above, each arrangement to be considered a column, with or without rules.

Maintenance in the House of Detention of deserters . .	£7	12	6
Sale of iron, rags, bones, and fat at ditto	42	5	2
Copies of Commitments to ditto	0	12	0
Sale of old bricks at ditto	47	10	0
Total receipt	£97	19	8

TABLE, TABULAR, AND COLUMN MATTER.

49. Two Columns.—Two justifications or arrangements to constitute half-measure—one-third extra.

London . . .	22 Hungerford Wharf.
Liverpool . . .	52 Henry Street.
Manchester . .	37 Brown Street.
Birmingham . .	26 Bull Street.

Merriman, Dr. . .	£1	1	0	Towers, G., Hertford	£0	10	6
Halford, E., M.D. .	1	1	0	Ince, John, Esq. .	0	10	6
Cogswell, Dr. . .	1	1	0	Dunn, Robert, Esq. .	0	10	6
Davies, J., Hertford .	0	10	6	Winslow, Forbes, M.D.	1	0	0

London (Euston Station), Newcastle, Durham	£6	10	0	£5	5	0
Edinburgh, Glasgow, Hull, Bristol, Carlisle .	6	6	0	5	5	0
Worcester, Cheltenham, Gloucester, Oxford .	5	15	0	4	15	0
Birmingham, Rugby, Leamington, Coventry .	5	5	0	4	5	0

	Age.	st.	lb.		Age.	st.	lb.
Indian Warrior .	5	8	4	Mouser . . .	3	5	10
Little David . .	4	7	10	Kidnapper . .	3	5	10
Cobnut . . .	4	7	8	Shakespeare . .	3	5	10
The Alp . . .	a	7	4	Barrel . . .	3	5	10

Mr. Benjamin Abbott.	Mr. Solomon Levy.
,, Geo. Abbott.	,, Joseph Lewey.
,, John Alton.	,, Philip Lewey.
,, Richd. Gully Amos.	,, D. Liddel.

PRICE ONE SHILLING AND SIXPENCE.

1. THE JUNIOR CLERK: A Tale of City Life. By Edwin Hodder. New Edition.

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2. THE BIBLE STORY-BOOK. By Rev. B. H. Draper. Thirteenth Edition. Engravings.

[*One-third extra only to be charged on the two-line letter line and following line.*]

Blue Cloth, No. 1	60,000 Yds.
Blue Cloth, No. 2	25,000 ,,
Duck	520,000 ,,
Blankets	32,000 No.

	s.	d.		s.	d.
Bronze Lamps, full size	10	0	to	20	0
Porcelain, plain and ornamented	16	0	to	25	0
Crystal, richly cut	25	0	to	45	0
Bronze Pillar Lamps, full size	12	6	to	21	6

Chap. XLVI. Arthur deals with Kriegsthurm's Assassins.
,, XLVII. The Plenipotentiary arrives at Turin.
,, XLVIII. The Preliminaries to the Treaty of Turin.
,, XLIX. The King comes out to marshal them.

CONTENTS FOR JUNE:—

I. Birds of Prey. A Novel. By the Author of *Lady Audley's Secret.*
II. The Dinner at Richmond. Illustrated by Alfred Thompson.
III. Bric-a-Brac Hunting. By Major Byng Hall.
IV. Letters from Lilliput. By Geo. Augustus Sala.

LIVERPOOL GRAND NATIONAL.

10 to 1 agst	Daisy (off, 100 to 9 t and w)	30 to 1 agst	Astrolabe (t)
100 to 7 —	Moose (t)	30 to 1 —	Helen (t)
100 to 7 —	Tennyson (t)	30 to 1 —	The Plover (t and off)
25 to 1 —	Clansman (t and off)		

GOVERNOR'S PRIZES.

Greek Verse	Verrall.
Latin Prose	Irwin. Giles.
Latin Verse (Master's Prize)	Irwin.

House of Correction at Pentonville:—

General Expenses	£7,167 8 11	
Tontine Annuities	267 3 8	
		£7,434 12 7

50. THREE COLUMNS.—Three justifications or arrangements to be charged one-half extra.

Marlborough . .	Melbourne . . .	May 10.
Indian Queen . .	Melbourne . . .	May 27.
Medway . . .	Melbourne . . .	April 17.
Essex	Melbourne . . .	May 7.

	Benevolent Fund.			Foundation.			Annual.		
	£	S.	D.	£	S.	D.	£	S.	D.
J. Smith, Esq.	10	7	6	16	0	0	5	0	0
H. Thomson, Esq. . . .	100	0	0	—			10	10	0
Sir J. Harriott	—			20	3	6	2	2	0
The Stationers' Company .	10	0	0	25	0	0	—		

INCE BLUNDELL CUP, for all ages.

Mr. Halewood's bk w b *Happy Jane*, by Pugilist—Merry England	beat	Mr. Wright's w b *May Queen*, by Chadburn—Tripp.
Mr. W. Brundrit's bk b *Action*, by Ghoorka—Sea Sick .	"	Mr. Jump's bk w d *Trumpeter*, by Sea Foam—Topsy.

For Length of Ear.

	Length.	Width.	Age. m.	d.
Mr. Beere's blue and white doe . . .	$20\frac{3}{4}$ in.	$5\frac{1}{4}$ in.	7	6
Mr. Beere's black doe	$20\frac{1}{2}$ in.	$5\frac{1}{2}$ in.	7	6

Self Colour.

Mr. Bennett's fawn doe	$18\frac{3}{4}$ in.	$4\frac{1}{2}$ in.	6 0

Weight.

Mr. Chittenden's bk and w doe 10 lb. 2 oz.	$19\frac{3}{4}$ in.	5 in.	7 7

Despatch Boxes, fitted complete . .	18s. 6d.	28s. 6d.	42s. 0d.
Writing Cases, portable leather . .	4s. 6d.	7s. 0d.	10s. 6d.
Work Boxes, rosewood	6s. 0d.	10s. 6d.	14s. 0d.
Work Baskets, lined silk . . .	10s. 6d.	12s. 6d.	16s. 0d.

Yacht.	Tons.	Owner.
2. Coquette	26 . .	Frederick Smalley.

51. Four Columns.—Four or more justifications or arrangements to be charged double.

F. Tayler	D. Maclise, R.A.	Dewint	Pyne
C. Fielding	Pickersgill, A.R.A.	Hunt	S. Prout
D. Cox, sen.	D. Roberts, R.A.	Leitch	J. Lewis
J. T. Harding	C. Stanfield, R.A.	Nash	P. Frith

	No.	Amount. £	s.	d.	Premiums Received. £	s.	d.	Income. £	s.	d.
Proposals received .	37	11,160	6	10						
Proposals completed and Policies issued	27	3,536	12	10	151	0	5	251	14	5

Present Meeting of the Shareholders.

	No.	£	s.	d.	£	s.	d.	£	s.	d.
Proposals received . .	643	147,835	0	9						
Proposals completed and Policies issued	438	79,068	8	11	4,746	12	10	2,748	9	1

Bonds of Letter B.

16096	18401	35810	37467	52574	53590	55121	62530
16104	18402	35812	38094	52716	53591	55201	62531
16110	18403	35813	38099	53096	53609	55211	62632
16115	18404	35815	38102	53099	54056	55633	

Bonds—Nos. Forfeited.

12,578	3,786	2,876	1,284
5,714	7,853	276	4,842
8,631	10,310	854	7,651
10,145	12,454	12,752	8,745

Order of Merit.		Marks.	Order of Merit.		Marks.
1.	Fraser, J. . .	2150	22.	Craig, R. M. . .	1565
2.	Dobson, G. E. .	2125	23.	M'Robin, A. A. .	1565
3.	M'Swiney, E. N. .	1975	24.	Garde, W. H. .	1540
4.	O'Brien, J. A. J. .	1975	25.	Jennings, C. B. .	1465

Mr. Barnett	1 1 1 1 0 1 1 1 1 1 1 1 1 0 1—13
Mr. Pope	1 1 1 1 1 1 1 1 1 1 1 0 0 1 1—13
Mr. Cook	1 0 1 1 0 1 1 1 1 1 1 1 1 1 0—12
Mr. Ray	0 1 0 1 1 0 1 1 1 1 1 0 1 1 1—11

Names.	Birds.	Total.
Capt. Geo. Cozens	0 1 1 0 0 1 0 0	ret—3
Marquis of Beaumont	1 1 0 0 0 1 0 1 1	—5

Tie for First Prize.

J. Stot	1 1 1	W. Telford . . .	1 1 0

Stat.	Yacht.	Tons.	Owner.
1.	Alarm . . .	20 . .	George Chamberlain.

For Length of Ear.

Prize.		Length.	Width.	Age. m. d.
1.	Mr. Bennett's tortoiseshell buck . .	19¾ in. . .	4¾ in. . .	7 12
2.	Mr. Chitten's black and white buck .	17½ in. . .	4½ in. . .	2 21
3.	Mr. Reid's yellow and white buck .	19 in. . .	5 in. . .	2 28

No.		Votes.	No.		Votes.
4.	Addison, James . .	823	1.	Bentley, Edwin Thomas	217
5.	Mace, William Francis	822	19.	Wills, Thos. Wm. .	192
23.	George, Edward . .	745	32.	Fabrian, W. Grant .	162
37.	Packwood, W. H. .	622	15.	Rigden, H. Thompson .	143

Yrs.	Name.	st. lb.	Yrs.	Name.	st. lb.
1 . .	John . . .	6 4	3 . .	Wm. . .	6 8
a . .	George . .	6 6	2 . .	Jinks . .	6 6

52.—Matter set to less than 16 ems of its own body, and not being table, tabular, or column matter, to be charged one-fourth extra ; less than ten ems of its own body, one-third extra.

53.—The top and bottom rules of a table to be charged as distinct lines, double ; but cross rules in the body of a table to be reckoned in the depth.

54.—The signature, date-line, and rule, after a table, if making three lines, to be charged as common matter.

55.—Title-headings to table or tabular matter, not exceeding five lines, to take the charge of the matter to which they are attached; above five lines, no extra to be charged.

56.—Common matter occurring between table or tabular, not being headings, to take no extra charge.

SCHEDULE FOR LOST TIME AND OVERTIME—BOOK AND NEWS.

Amount per week.	Rate per hour.	Lost time per hour. $\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	Overtime $3\frac{1}{2}d.$ per hour.	Overtime 4*d.* per hour.	Overtime 5*d.* per hour.
£ s. d.	d.	d.	d.	d.	s. d.	s. d.	s. d.
1 18 0	8½	2	4	6	1 0	1 0½	1 1½
2 0 0	9	2	4½	6½	1 0½	1 1	1 2
2 2 0	9½	2½	4½	7	1 1	1 1½	1 2½
2 4 0	9¾	2½	5	7	1 1½	1 1¾	1 2¾
2 5 0	10	2½	5	7½	1 1½	1 2	1 3
2 6 0	10¼	2½	5	7½	1 1¾	1 2¼	1 3¼
2 8 0	10¾	2½	5½	8	1 2½	1 2¾	1 3¾
2 10 0	11¼	3	6	9	1 2¾	1 3¼	1 4¼

The above schedule for lost time is not intended to interfere with rules governing each office.

In the event of any question arising whereon either the Book or News Scale is silent or not clearly defined, such question shall be governed by the custom of the trade (if any) or decided by mutual agreement; it being understood that for work of an exceptional character the compositor is entitled to charge such special rates as will adequately remunerate him for the time occupied on the work.

INDEX TO NEWS SCALE.

London Rates and Rules for Working Composing Machines.—The following were agreed upon in July, 1896, between representatives of the London morning, evening, and weekly newspaper proprietors and master printers, and delegates of the London Society of Compositors:—

COMPOSING MACHINES—NEWS SCALE.

Daily Papers.

1.—All skilled operators, justifiers, and distributors (as distinct from attendants or labourers) shall be compositors and members of the L.S.C.

2.—Members of companionships into which machines are introduced or existing installations increased shall be given facilities to learn them in their own time (matter so composed not to be used), and when learners have reached an output of 4,000 ens in a test hour, or 12,000 ens in a test of four hours, preference shall be given to such qualified learners, and they shall be paid (when put on machines) for six weeks their average earnings of the previous three months.

3.—In all offices where composing machines of any description are introduced, or are in use, composition to be commenced simultaneously; and on morning papers the "cut" to apply to both case and machine hands, any stoppers required to be in the proportion of three case hands to one machine. Disadvantageous portions of articles not to be selected for either case or machine; and copy generally, whether advertisements or news matter, to go out in fair proportion. Case hands and operators to lift from separate heaps of copy, but when one heap is run out copy to be taken from the heap remaining for either case or machine hands. Compositors and operators in such offices to be guaranteed two galleys (7s. 8d.) per day of seven working hours on morning papers; on evening papers twelve galleys (£2 3s.) per week of 42 hours. This not to interfere with the existing guarantee of a galley on first edition of evening papers.

Machines may be employed on morning papers in the day-time, provided that three case hands are called in to each machine, and that not more than three machines are thus employed. The earnings of such operators to be restricted to £3 per week.

4.—Any machine hand required to go upon time to be paid at the ordinary rate of the office. The same rate of payment to apply to

any case hand sent temporarily to a machine, and to any machine hand sent temporarily to case. This regulation to apply only in case of emergency.

5.—No man shall be permanently changed from machine to case, or *vice-versâ*, without a fortnight's notice.

6.—The scale of prices for machine work shall be:—

Linotype:

3¼d. per 1,000 ens for day work in evening paper offices.

3½d. per 1,000 ens for work done in morning paper offices.

¼d. per 1,000 ens extra on all types above brevier.

Matter requiring two bars to complete one measure (not being tabular matter) to be charged one-third extra; three or more, one-half extra.

Hattersley:

4d. per 1,000 ens for evening paper work, and

4½d. per 1,000 ens for morning paper work.

Distribution to be paid for at a minimum rate of 38s. per week of 48 hours day work, or 3d. per 1,000 piece work.

Empire:

4½d. per 1,000 ens for evening paper work, and

5d. per 1,000 ens for morning paper work.

¼d. per 1,000 ens extra for measures below 20 ems of its own body.

Distribution to be paid for at a minimum rate of 38s. per week of 48 hours day work.

Machine operators on morning papers to be paid 4d. per hour extra for the first hour after seven hours' work, and 6d. per hour afterwards. On evening papers they shall be paid 4d. per hour extra for all hours between 42 and 48 per week, and 6d. per hour extra afterwards. At any time after nine hours' consecutive work 3d. per hour extra shall be charged, when overtime is not otherwise chargeable.

7.—All stoppages of ten minutes and upwards to be cumulative, with a minimum charge of twenty minutes, and to be charged at the ordinary time rate of the office. Such charges to be countersigned by the mechanic.

8.—Twelve lines of 16 ems pica or less, or its equivalent in wider measures, to constitute a machine "take" of copy; less than that number to be charged as twelve lines (or its equivalent).

9.—All standing headings to be charged by the operator. All leads and rules, other than those required in making up, to be charged by

the operator. When leads are cast on the bar, the operator to charge half the additional depth, the time taken in changing knives not to be counted a stoppage. Headings not composed by the operator to be given out to the piece hands.

10.—Matter of and above four lines composed in other than ordinary English (*e.g.*, dialects) to be charged one half extra, and foreign languages double for each line.

11.—Matter consisting of names run on and figures—*e.g.*, prize lists, balance sheets, Gazette news, programmes, etc.—shall, where exceeding eight lines, or where containing fractions, signs, or accents, where exceeding two lines, be charged one-fourth extra; one line extra to be charged for each word of small caps, italics, or clarendon, etc. When two-line-letter matrices are dropped in, they shall be charged one line extra for every two two-line letters.

12.—The usual piece regulations as to bad copy or MS. to apply to operators; copy not properly sub-edited to rank as bad MS.

13.—All first-proof and revise corrections (marks left undone in the first proof) to be done by the operator, except machine errors and house marks, which shall be charged double. Charges for machine errors to be countersigned by the mechanic.

14.—If a machine is changed by order to a different type, operators shall not be required to change it again to make corrections, which shall be done by the operator on a vacant machine, or by the house.

15.—Matter which requires more than one justification for the purpose of ranging to be paid for in proportion to the time occupied.

16.—No operator shall be compelled to do engineers' or labourers' work.

Weekly Papers.

1.—All skilled operators, justifiers, and distributors, as distinct from attendants or labourers, shall be compositors and members of the L.S.C. Apprentices in the last two years of their time can be employed in due proportion to the number of journeymen operators —*i.e.*, one apprentice to three journeymen operators.

2.—Members of companionships into which machines are introduced or existing installations increased shall be given facilities to learn them in their own time (matter so composed not to be used), and when learners have reached an output of 4,000 ens in a test hour, or 12,000 ens in a test of four hours, preference shall be given to such qualified learners, and they shall be guaranteed (when put on machines) for six weeks 38s. per week of 48 hours.

3.—In all offices where composing machines of any description are introduced, or are in use, composition to be commenced simultaneously. Disadvantageous portions of articles not to be selected for either case or machine; and copy generally to go out in fair proportion. Case hands and operators to lift from separate heaps of copy, but when one heap is run out copy to be taken from the heap remaining for either case or machine hands. But giving out complete articles not to be considered a breach of this rule. When operators and case hands work together on the same papers they shall be guaranteed a quarter per hour (unless exempted by the Chapel) while the line is on.

4.—Any machine hand required to go upon time upon machine work shall be paid 1s. per hour, but any operator required to go upon stone work shall be paid at the ordinary time rate of the office, such work to be confined to papers produced wholly or partially by machinery.

5.—No man shall be permanently changed from machine to case, or *vice-versâ*, without a fortnight's notice.

6.—The scale of prices for machine work shall be:—

Linotype:

$3\frac{1}{8}$d. per 1,000 ens.

$3\frac{1}{4}$d. per 1,000 ens for all types above brevier.

Matter set to less than 20 ems of its own body, or more than 24 ems pica in type below bourgeois, to be charged $\frac{1}{4}$d. per 1,000 ens extra. Matter requiring two bars to complete one measure (not being tabular matter), to be charged one-third extra; three or more, one-half extra.

Hattersley:

4d. per 1,000 ens.

Distribution to be paid at a minimum rate of 38s. per week of 48 hours.

Empire:

$4\frac{1}{4}$d. per 1,000 ens.

$\frac{1}{4}$d. per 1,000 ens extra for measures below 20 ems of its own body.

Distribution to be paid for at a minimum rate of 38s. per week of 48 hours.

Overtime to be paid at the same rate as case hands, taking the day as eight hours.

7.—All stoppages of ten minutes and upwards to be cumulative;

with a minimum charge of twenty minutes, and to be charged at the rate of 1s. per hour. Such charges to be countersigned by the mechanic.

8.—Twelve lines of 16 ems pica or less, or its equivalent in wider measures, to constitute a machine "take" of copy; less than that number to be charged as twelve lines (or its equivalent).

9.—All standing headings, leads, rules, etc., other than those required in making up, to be found and placed on the galley and charged by the operator. Where leads are cast on the bar, the operator to charge half the additional depth, the time taken in changing knives not to be counted a stoppage. Headings not composed by the operator to be given out to the piece hands. In no case are complete block-headings or blocks to be charged.

10.—Matter of and above four lines composed in other than ordinary English (*e.g.*, dialects) to be charged one-half extra, and foreign languages double for each line.

11.—Matter consisting of names run on and figures—*e.g.*, prize lists, balance sheets, Gazette news, programmes, etc.—shall, where exceeding eight lines, or where containing fractions, signs, or accents, where exceeding two lines, be charged one-fourth extra; one line extra to be charged for each word of small caps, italics, clarendon, etc. When two-line-letter matrices are dropped in they shall be charged one line extra for every two two-line letters. Rules to advertisements and leads to be put in and charged by the operator.

12.—The usual piece regulations as to bad copy or MS. to apply to operators; copy not properly sub-edited to rank as bad MS.

13.—All first-proof and revise corrections (marks left undone in the first proof) to be done by the operator, except machine errors and house marks, which shall be charged double. Charges made for machine errors to be countersigned by the mechanic.

14.—If a machine is changed by order to a different type, the operator shall not be required to change it again to make corrections, which shall be done by the operator on a vacant machine or by the house.

15.—Matter which requires more than one justification for the purpose of ranging to be paid for in proportion to the time occupied.

16.—One-fourth extra, to the full width of the article, to be charged for matter run down blocks.

17.—The minimum rate for establishment hands shall be 45s. for 48 hours.

18.—No operator shall be compelled to do engineers' or labourers' work.

Book Scale.

1.—All skilled operators, justifiers, and distributors, as distinct from attendants or labourers, shall be compositors and members of the L.S.C. Apprentices in the last two years of their time can be employed in due proportion to the number of journeymen operators —*i.e.*, one apprentice to three journeymen operators.

2.—Members of companionships into which machines are introduced or existing installations increased shall be given facilities to learn them in their own time (matter so composed not to be used), and when learners have reached an output of 4,000 ens in a test hour, or 12,000 ens in a test of four hours, preference shall be given to such qualified learners, and they shall be guaranteed (when put on machines), for six weeks, 38s. per week of 48 hours.

3.—Any machine hand required to go upon time upon machine work shall be paid 1s. per hour, but any operator required to go upon stone work shall be paid 9½d. per hour.

4.—No man shall be permanently changed from machine to case, or *vice-versâ*, without a fortnight's notice.

5.—The scale of prices for machine work shall be:—

Linotype:

3d. per 1,000 ens.

3⅛d. per 1,000 ens for all types above brevier.

Matter set to less than 20 ems of its own body, or more than 24 ems pica in type below bourgeois, to be charged ¼d. per 1,000 ens extra.

Matter requiring two bars to complete one measure (not being tabular matter) to be charged one-third extra; three or more, half extra.

Hattersley:

4d. per 1,000 ens.

Distribution to be paid for at a minimum rate of 38s. per week of 48 hours.

Empire:

4¼d. per 1,000 ens.

¼d. extra per 1,000 ens for measures below 20 ems of its own body.

Distribution to be paid for at a minimum rate of 38s. per week of 48 hours.

Overtime to be paid for at the same rate as case hands, taking the day as eight hours.

6.—All stoppages of ten minutes and upwards to be cumulative, with a minimum charge of twenty minutes, and to be charged at the rate of 1s. per hour. Such charges to be countersigned by the mechanic.

7.—All leads, rules, etc., other than those required in making-up, to be charged by the operator. Where leads are cast on the bar, the operator to charge half the additional depth; the time taken in changing the knives not to be counted a stoppage.

8.—Matter of and above four lines composed in other than ordinary English (*e.g.*, dialects) to be charged half extra, and foreign languages double for each line.

9.—Matter consisting of names run on and figures—*e.g.*, prize lists, balance sheets, Gazette news, programmes, etc.—shall, where exceeding eight lines, or where containing fractions, signs, or accents, where exceeding two lines, be charged one-fourth extra. One line extra to be charged for each word of small caps, italics, clarendon, etc. When two-line-letter matrices are dropped in, they shall be charged one line extra for every two two-line letters.

10.—The usual piece regulations as to bad copy or MS. to apply to operators; copy not properly sub-edited to rank as bad MS.

11.—All first proof and revise corrections (marks left undone in the first proof) to be done by the operator, except machine errors and house marks, which shall be charged double. Charges for machine errors to be countersigned by the mechanic.

12.—If a machine is changed by order to a different type, the operator shall not be required to change it again to make corrections, which shall be done on a vacant machine, or by the house.

13.—Disadvantageous portions of articles in magazines and serials not to be selected for either case or machine. This not to apply to volume work.

14.—Matter which requires more than one justification for the purpose of ranging to be paid for in proportion to the time occupied.

15.—One-fourth extra, to the full width of the article, to be charged for matter run down blocks.

16.—The minimum rate for establishment hands shall be 45s. for 48 hours.

17.—All matter to be set in slips and made up by the house.

18.—No operator shall be compelled to do engineers' or labourers' work.

"Resolved, that in cases of dispute between the London Society

of Compositors and any London newspaper proprietors or printers in regard to the interpretation to be placed upon the foregoing rules, the point at issue may, at request of either side of the parties concerned, be referred for arbitration to a Committee consisting of five employers' representatives and five representatives of the London Society of Compositors—the gentlemen forming such Committee of Arbitration to be nominated hereafter by the Employers and Society respectively."

CHAPTER C.

THE MACHINE ROOM OPERATIVES.—Overseer—Managers or Minders —Cropper Hands—Wages—Notice—Custom as to Unlocking Formes—Machine Boys.

MACHINE-WORK is comparatively a modern institution of the printing business, and therefore its customs have not been so fully defined and settled as those of the composing room.

In large establishments the workers in a machine room are regarded as belonging to three classes :—

1. The machine overseer.
2. The machine minders or managers.
3. The machine lads.

The *Machine Overseer* is responsible generally for the management of the machine room, the conduct of the employees, and the character of the work turned out. He also keeps the necessary account of the output of each machine, and the time the various jobs are begun and finished. An incapable man in this position causes much loss and annoyance. It is his duty to keep the machines running as many hours as possible out of the working day, taking care that overlays are as far as may be prepared beforehand, instead of keeping the machine idle while they are being cut out, and that too much time is not spent in making ready. He is also responsible for maintaining the quality of any particular job to the exact standard approved of by the general manager of the establishment. He must be a man of nerve, firmness, and ready resource, prepared to deal with any of the accidents to machinery, material, or person from which no office is entirely free.

The *Machine Minder* is of course one who "minds" or takes care of a machine. Such journeymen are now usually spoken of as "machine managers."

Machine Lads are called "layers-on" or "feeders" and "takers-off," according to their duties. In daily newspaper offices, and others where night work is prevalent, the Factory Laws necessitate the employment of men to feed such machines as are not self-feeding.

The practice of sub-division of labour has been now carried out to such an extent that men and boys are kept almost constantly at one kind of work, or at one kind of machine. Thus we have a "pointer," that is, a layer-on who can point for register or bookwork, and a "Cropper hand," usually a lad who can treadle and feed a Minerva or other platen machine.

The machine overseer superintends the various minders, who in their turn superintend the lads. The overseer in some offices is required to fill up his time by making ready overlays for the different machines. A proof of every job is brought to him before it is worked off, and he is held responsible for the making ready, overlaying, colour, etc., at the start. If the minders, however, deviate from the colour settled upon at the beginning, or allow of bad work—such as creasing, formes rising, etc.—they are held responsible. It is their place, too, to see that the laying on is accurately done, and the "backing" or perfecting correct.

Wages.—Machine managers rarely, if ever, work on piece, and there is no such thing as a piece scale for machine work. They are paid by time at so much per week. The minimum recognised rate in London is now 38s. per week, but good men command higher wages, and £3 or £4 a week is often paid to machine overseers.

Notice to Leave.—It is usual in the case of machine managers and pressmen to give or take on either side a fortnight's notice or a fortnight's wages. In the case of

a machine overseer four weeks' notice is usual. Special arrangements may, however, be made by mutual consent. Men leaving without notice may be fined by magistrates and may be ordered to pay damages as stated in the chapter following.

Unlocking Formes.—There is frequently a controversy in a printing office as to whether a machine minder ought to unlock a forme after it has left the composing room. Compositors allege that in so doing formes are frequently sent off their feet, entailing trouble and expense in getting them right again. Perhaps a solution of the difficulty may be reached by considering that in the sub-division of labour now necessary in every large printing office, the men of each department begin their task at a certain point and finish it at another certain point; but this line of demarcation should not be too finely drawn—things should not break off too suddenly at the edge of each department. In the matter of adjusting the types the compositor is expected to know his business, and the machinist's duty is to print them. Where the compositor's duties cease the machinist's begin. The compositor has to make his forme lift, to see that the rules and corners join, and to make the whole portable, like one solid piece of metal. Nevertheless, the forme in this condition may be level enough to pull a proof from, but it is rarely level enough to be stereotyped or to go to machine. The machinist has to see that it is fit to print from, and he makes sure of that by unlocking it all round. If the compositor's work has not been thoroughly done, or if the justification is imperfect, this results in considerable trouble, but it falls on the person responsible. The machinist, too, is best able to judge how tight his forme should be to work safely. If he is a careful man he will lock it up himself, rather than run the risk of having it "sprung" by the compositor. Stereotypers, who must have a level forme or they cannot get an even surface plate,

nearly always unlock the forme. The machinist requires a level forme as well, for if it be in the least sprung he cannot make it ready properly, nor run on with it long together; for under pressure it will sink in patches, and the overlays will be useless. It is advisable, too, for the machine minder, after having worked off a job, to lock up the forme all round previous to lifting it from the machine. He has been working it somewhat loose, to prevent a spring, and it will not come safely off the machine unless it is tightened up.

Machine Boys.—As to these the reader is referred to pages 744 and 800 of Vol. I. They earn a few shillings per week and may be dismissed, or may discharge themselves, after giving a week's notice. For misconduct they may be dismissed summarily.

Machine boys in London and other large towns often give great trouble and cause much inconvenience and loss from stoppage of work by absenting themselves without notice, either to play or, as they call it, "mike," or to seek other employment. Such absence gives the employer the right to dismiss the delinquent without notice, and without payment for any wages accruing since last pay day; and, on the other hand, the boy may be punished by the magistrate, if summoned for the offence.

CHAPTER CI.

EMPLOYERS AND WORKMEN.—A few Legal Memoranda concerning their respective Rights and Duties.

WITHOUT intending in any way to give an exhaustive statement of the law of employers and employed, we will present here a few of the leading propositions.

Losing Time and Making it up.—Though workmen in the printing trade are paid so much per week, if they lose time they lose pay, and if they work overtime they get extra pay. And the pay is lost even if illness be the cause of the absence. Where a compositor, not being away through illness, loses time in ordinary hours, he may generally be required to make it up in overtime. In London "Society" houses, if a compositor loses time he may on the same day, but not on another day, be required to make it up after ordinary hours; but if he works after eight o'clock his pay must be calculated at the overtime rate, even though he has not at eight o'clock made up his lost time.

Notice.—Except for good cause, a master cannot dismiss his servant without giving him notice. The length of the notice is fixed either (*a*) by agreement, (*b*) by the custom of the trade, or (*c*) it must be what the tribunal will consider a reasonable notice.

If when a servant is engaged he is informed that there are rules of the house, and those rules are brought to his notice, he is bound by them even if he does not choose to read them; and he is also bound by them if they are made or are brought to his notice after his engagement, and

without objecting to be bound by them he continues in the service of the employer. A rule that the length of notice to be given and taken shall be seven days will override the custom of the trade to give fourteen days' notice. This was decided in a case reported in the *Printers' Register* for August, 1895. So where a compositor was engaged for a year and was wrongfully dismissed, he got much more damages than he would had he been subject to the customary notice (*Printers' Register*, March, 1896). Where a custom is relied upon in a court of law the custom must be proved to exist by witnesses well acquainted with it and the trade, that is, unless the opposite party admits the custom.

Notice to Quit.—In the absence of express agreement the customary notice must be given.

By custom the length of notice given and taken by—

A compositor . . .	is .	Two weeks.
A machine minder . .	,, .	,,
A reader . . .	,, .	,,
An overseer . . .	,, .	Four weeks.
Head of department .	,, .	One to six months (according to status).
A clerk paid by the year	,, .	Usually a month.
A clerk paid by the week	,, .	One or two weeks.
A lad paid weekly . .	,, .	One week.
A reporter . . .	,, .	One month.
A sub-editor . . .	,, .	Three months.
An editor . . .	,, .	Three to six months.

But the custom must be proved as above stated.

It is a custom in the London printing trade that a compositor may at any time within the first fortnight of his engagement leave his situation or be discharged therefrom without notice. In such a case he receives pay for the time actually worked, save that if the man be employed on the 'stab and the master dismisses him on the first day, he must pay him a full day's wages, however short a time he

may have worked (see a case in the *Printers' Register* for August, 1882).

On the other hand, if a man comes to do a day's work and leaves off without completing it, he can recover nothing for what he has done (case in *Printers' Register* for February, 1897). So where a layer-on engaged by the week left without warning in the middle of a week he got nothing for the days he worked (cases in *Printers' Register* for August, 1897, and July, 1899; also Walsh *v.* Whalley, Law Reports 9 Q.B. 367).

The damages recoverable for wrongful dismissal cannot exceed the amount of the wages for the time during which notice would have run and may be less. It has been held that if a man wrongfully dismissed can at once obtain similar employment at equal wages he can recover only nominal damages ($\frac{1}{4}$d.) for the dismissal (Macdermott *v.* Muston, 1884, Cababé & Ellis's Reports, 281).

Notice to quit is generally given on the pay day, but it is doubtful if it may not be given on, and may count from, any other day. However, notice to quit given on a Saturday instead of a Friday night was once held by Commissioner Kerr to be bad (*Printers' Register* for October, 1899).

Summary Dismissal.—A servant may be dismissed summarily for disobedience to lawful orders, for insolence, for gross incompetence, for drunkenness incapacitating him from duty, for absenting himself without leave, for negligence involving serious consequences, for habitually coming late, for habitual neglect of duty, for disclosing his master's secrets or otherwise acting unfaithfully, and for crime.

Summary dismissal of a machine minder who stayed away without notice was justified in a case reported in the *Printers' Register* for July, 1899. Another machine minder was summarily dismissed because he negligently allowed his machine to be seriously injured, and the dismissal was held justified (Baster *v.* London & County Printing Works, Law

Reports, 1899, 1 Q.B. 901, also reported in the *Printers' Register* for May, 1899). The instant dismissal of a layer-on who by larking injured a machine was held justified (*Printers' Register* for October, 1898). Layers-on who refused to feed certain machines were held to be properly dismissed (*Printers' Register* for July and November, 1898). "A printer who quitted his work shortly before a newspaper went to press might no doubt be dismissed" (Macdonell on Master and Servant, p. 209, and see More *v.* Leech, *Printers' Register*, October, 1882). Masters were held justified in discharging men who habitually came late (*Printers' Register*, December, 1879, and December, 1884, and *Printing Times* for May, 1876). As to drunkenness see *Printing Times* for June, 1878, and as to other misconduct see *Printers' Register* for October, 1883.

Leaving without Notice.—A servant who leaves his work without notice and thereby causes his master loss may be ordered to pay damages. Cases of this kind are frequent. Thus, a machine minder had to pay 45s. damages to Messrs. Waterlow & Sons, Ltd. (*Printers' Register*, December, 1895); another machine minder had to pay his employer £2 (*Printers' Register*, July, 1898); a bookbinder's man paid £2 14s. (*Printers' Register*, June, 1899); a foreman had to pay two weeks' wages (*Printers' Register*, March, 1900); a layer-on was ordered to pay 18s. (*Printers' Register*, 1898; another case, *Printers' Register*, December, 1898); a Cropper hand had also to pay (*Printers' Register*, August, 1897). In James *v.* Evans (1897), 16 *Times* Law Reports 490, a man had to pay £10 for staying away a fortnight. Sometimes, too, the delinquent is fined, and in default of payment is imprisoned. When a wetter of paper took himself off without warning and thereby caused machines to stand idle, he was fined 20s. and costs or ordered to be imprisoned for 14 days.

As before stated, a weekly servant who takes himself off

in the middle of a week forfeits all the wages he has earned since the last pay day. See cases of this kind in the *Printers' Register* for February and August, 1897, and July, 1899.

Overtime.—It is a moot point on which there are conflicting decisions whether a man can be summarily dismissed if he refuses to work overtime, and whether he can be made to pay damages for so refusing. The tendency of modern decisions is not to compel a man to work overtime unless he has expressly or impliedly agreed to do so. An implied agreement may be inferred from the nature of the work undertaken. Thus, men who undertake newspaper work, parliamentary work, or the printing of evidence for law cases, may be held to have impliedly agreed to work overtime till the task is accomplished (see cases cited in Powell's Law Affecting Printers, pp. 51, 52, and cases reported in the *Printers' Register* for March, 1896, and July, 1897).

Refusing to Work.—A man who refuses to do the kind of work he was engaged to perform may be summarily dismissed, and he may also be sued by his employer for such damages as the latter may suffer by such refusal (see cases in *Printers' Register* for July and November, 1898). Thus, a lad who being refused a holiday took one was ordered to pay 7s. 6d. and costs (*Printers' Register*, September, 1876). Where men had engaged themselves, but on hearing that there was a strike at the office, declined to work, they were ordered to pay the employer damages (*Printers' Register* for June, 1896, and May, 1898); and a Cropper hand who did the like shared a similar fate (*Printers' Register* for August, 1897).

Spoiled Work.—Every one who hires himself out to do work of a certain class impliedly warrants that he has the skill necessary to perform that work and will use it. If through want of skill or care he spoils work or injures machinery entrusted to his care, he may not only be dismissed, but

he may also be made to pay the damage he occasions to his employer. To recover such damages an action must be brought (usually in the County Court): the amount cannot be deducted from the man's wages unless the provisions of the Truck Act, 1896, are complied with, as to which see below.

Fines.—These may be imposed only where they are reasonable and where the provisions of the last-mentioned Act are complied with.

The Truck Act, 1896, strictly limits the right to withhold wages for fines or to make good damage, etc. It provides that, to entitle such withholding, the terms of the contract to pay damages or fines must be contained in a notice constantly posted up in a conspicuous place, or be in writing, signed by the workman; the contract must specify what a man may be fined for and the amount of each fine, and fines may only be imposed in respect of some act or omission which causes, or is likely to cause, damage or loss to the employer or interruption or hindrance to his business, and as regards deductions for losses, they must not exceed the losses or estimated losses. Furthermore, when any deduction is made there must be handed to the workman particulars in writing showing clearly in respect of what it is made.

Liability for Personal Injuries.—An employer is bound by the Common Law to take reasonable care that all machinery and tools supplied to his workmen shall be reasonably fit, and also to take reasonable care that the persons he engages to work with or alongside fellow-servants are reasonably fit.

A workman is entitled to damages from his employer under the Employers' Liability Act, 1880, if he is injured (*a*) by reason of a defect in the condition of the ways, works, machinery, or plant connected with or used in the business of the employer, such defect having arisen from or not having been discovered or remedied owing to the negligence

of the employer or of some person in his service and entrusted by him with the duty of seeing that the ways, works, machinery, or plant are in proper condition, or (*b*) by reason of the negligence of any person in the service of the employer who has any superintendence (as defined by the Act) entrusted to him whilst in the exercise of such superintendence, or (*c*) by reason of the negligence of any person in the service of the employer to whose orders or directions the workman at the time of the injury was bound to conform and did conform where such injury resulted from his having so conformed. Provided that the workman cannot recover where he knew of the defect or negligence which caused his injury, and failed within a reasonable time to give or cause to be given information thereof to his employer or some person superior to himself in the service of the employer, unless he was aware that the employer or such superior already knew of the defect or negligence.

Under this Act it is necessary to give formal notice of the injury within six weeks.

By virtue of the Workmen's Compensation Act, 1897, every person employed in a printing office who is injured there by accident arising out of or in the course of his employment, and who by such accident is prevented for at least two weeks from earning full wages at the work at which he was employed, is entitled to compensation at the hands of his employer, provided his injury is not attributable to his own serious and wilful misconduct. The compensation is payable weekly, and is limited to 50 per cent. of the man's average weekly earnings or £1, whichever is least. The compensation is payable during the incapacity—even for life, but nothing is paid for the first two weeks' incapacity. If death ensues the employer has to compensate the dependants, or if there be none he has to pay the deceased's funeral expenses.

Claims for compensation under the Act must be mad

within six months of the accident, and notice of the accident is to be given as soon as possible.

By the Factory Acts, 1878 and 1891, all dangerous parts of the machinery used in a printing office, and every part of the mill gearing (*i.e.*, the shafting, straps, etc.), must either be securely fenced or be in such position or of such construction as to be equally safe to every person employed or working in the factory as it would be if it were securely fenced.

This is a far-reaching enactment, and if by reason of the want of a fence or guard an accident happens, even to the man working the machine, the employer is liable to compensate the injured workman and to pay a fine. Cases where fines were imposed are reported in the *Printers' Register* for November, 1895, December, 1896, and June, 1898. Platen machines were held dangerous in a case reported in July, 1899, and guards protecting the operator from getting his hand crushed between the bed and the platen are now obtainable and should be used. It is no defence to say the guards hinder work, if the work can be done with them.

The employer's liability for personal injury being so great, every prudent master printer now insures against it.

Forum.—Disputes between employers and workmen are generally settled either in a County Court or in a Magistrate's Court: the latter has jurisdiction whenever the amount in dispute does not exceed £10. *Cf.* the Employers and Workmen Act, 1875.

CHAPTER CII.

APPRENTICES.—The Indenture—Term—the Master's Rights—the Apprentice's Rights—Changing Masters—Turnovers—Cancelling the Indenture—Disputes between Masters and Apprentices—Liability of Father or Guardian—Apprentice's Wages—Coming out of his Time—Technical Instruction—Bonuses—Limitation of Number of Apprentices.

Apprentices.—In the printing trade there are two kinds of apprentices, indoor and outdoor. The first-named are understood to be lodged and maintained by the master in his own dwelling-place. This now is only adopted in a very few instances, and chiefly by small employers. Some of the large offices, however, have dwelling-houses connected with them in the immediate neighbourhood, where the apprentices reside under the charge of a matron. Outdoor apprentices, on the other hand, live with their families or friends, and receive a certain remuneration in lieu of their maintenance. If a sum of money be paid to the master in consideration of his teaching the boy his trade, it is known as a *premium*.

The Indenture.—This may consist of the time-honoured and simple form of which copies on parchment are to be bought at all the law stationers', or be a more elaborate document embodying special clauses, some for the protection of the master, others for the benefit of the apprentice. The lad is "bound" to learn the trade "of a printer," or more frequently some branch of that trade, as that "of a compositor," or that "of a pressman and printing machine manager."

The apprentice being almost always a minor, his father

or other guardian is made a party to the indenture, and covenants with the master that the apprentice shall faithfully serve him during the term of apprenticeship.

The stamp duty on an indenture of apprenticeship is 2s. 6d. if no premium is paid; if there be a premium it is 5s. for every £5 or fractional part of £5 of the amount or value of the premium or consideration given.

Term of Apprenticeship.—The recognised term of apprenticeship in all branches of the trade is seven years, and the trade unions will not admit a man as a member unless he has served that period. It is, however, perfectly legal to fix the term at a shorter period. But whatever it is, the apprentice is by law required to work it out; should he go away, his master may recover him, and get an order from a magistrate's court that he complete his term of servitude, and the period of his absence does not count, although he may have been working at his trade during such absence.

There are two exceptions to this rule as to completing the service. In the first place, if the terms of the apprenticeship are such as the court thinks not beneficial to the lad, the lad can refuse to be bound by the indenture. Again, when he comes of age he may elect not to be bound by the indenture, even though it be perfectly fair. The result of his doing so is to make his father or guardian who covenanted for his due service liable to compensate the master, unless there is a special clause to provide against this. Should a lad continue to work after attaining his majority, he will be held to have elected to be bound by the indenture, and he cannot afterwards change his mind and go.

The Master's Rights.—The master has the right to the services of his apprentice on all working days and during all ordinary working hours, and he is entitled to all the apprentice's earnings.

It has been held by the Chamberlain of London that a master cannot insist on his apprentice working overtime

(Scott *v.* Howell, reported in the *Printers' Register* for January, 1885).

A person who entices an apprentice away from his master may be sued by the latter for damages.

A master has no right to dismiss an unruly, disobedient, or idle apprentice; his course is to take him before a magistrate and get the lad punished or ordered to do his duty on pain of punishment. But if the lad is a thief he may dismiss him and cancel his indenture.

The Apprentice's Rights.—The apprentice is entitled to be properly taught the whole trade his master has contracted to teach him, and if the master keeps him at one kind of work or refuses to give him instruction or experience in some kinds, the apprentice may summon him before a magistrate, who may order the master to do his duty and make him find sureties for due obedience to the order, or in a bad case may order the indenture to be cancelled. The master is as much bound by his covenants to teach and to give board and lodging or to pay wages as the apprentice is bound to serve faithfully. Cases where a master has been summoned for not properly teaching his apprentice are reported in the *Printers' Register* for November, 1897, and November, 1898.

Where an apprentice has been taken to learn the whole of a trade it is no answer for the master to say that he has ceased to carry on more than a branch of that trade. If the lad is an indoor apprentice he has the right to proper food and lodging and also to medical attendance, unless this is otherwise provided for in the indenture. Where wages or allowances are payable they must be duly paid. Further, an apprentice is entitled to be taught in the neighbourhood where the master was carrying on business when he was apprenticed, and he cannot be compelled to follow his master from one town to another (so decided in Paton *v.* Western, "Law Reports," 9 Queen's Bench Division, p. 636).

It was held in 1878 that if an apprentice reasonably apprehended grievous harm from his master he might lawfully absent himself, but mere unkindness, niggardliness, or rough behaviour do not excuse an apprentice's running away.

An apprentice who works overtime is entitled to overtime pay (see White *v.* Smith in the *Printers' Register* for November, 1884).

Change of Masters.—This can be effected by mutual consent, the apprentice being duly assigned to the new master. He is then known as a "turnover." A lad has no right to leave his master and go to another without the consent of the first, even though the wages paid him be inadequate.

The London Society of Compositors has a salutary rule on the subject of "turnovers," as follows:—

> That all persons known by the name of "turnovers" shall be rebound to an employer by means of a legal or written witnessed agreement within a period of one month from entering an office; and unless this agreement be produced at the completion of their servitude, they shall not be admitted to this Society without the sanction of the committee.

Death and Bankruptcy.—If the apprentice dies, the master keeps the premium, unless the indenture otherwise provides. If the master dies, the apprenticeship is at an end, unless the indenture provides that the lad shall continue to serve the executors or unless the apprenticeship be in the City of London. Should the master become bankrupt the apprentice may claim his freedom, or require to be assigned to another master.

Cancelling of the Indenture.—This cannot be done by a master of his own accord; it can only be done by mutual consent of all parties, or by a magistrate.

Disputes between Master and Apprentice.—These are usually settled in the Magistrates' Courts. By the Employers and Workmen Act, 1875, the magistrates have power: (*a*)

to make an order directing the apprentice to perform his duties under the apprenticeship; (*b*) to cancel the indenture and, if thought fit, to order the whole or any part of the premium paid to be returned; (*c*) to imprison an apprentice for not more than fourteen days at a time when an order directing him to perform his duties has been made, and he has for a full month from the making of the order failed to comply with it; (*d*) to compel the attendance of any person liable under the indenture for the good conduct of the apprentice, and either in substitution for or in addition to any order against the apprentice himself, to order such person to pay damages to the master and [or] to take security from such person, if he is willing to give it, for the future good conduct of the apprentice.

In addition, the Magistrates' Courts have, in cases between master and apprentice, all the powers conferred by the Act in cases between employer and workman.

The Magistrates' Courts have no jurisdiction if more than £25 premium has been paid with the apprentice: proceedings must then be taken in the County Court or the High Court of Justice.

The Chamberlain of London has also jurisdiction over City apprentices, and may order them to be confined in Bridewell by way of punishment.

Liability of the Father or Guardian of the Apprentice.—As before stated, the father or guardian who joins in the indenture of apprenticeship, and covenants for the faithful service of the apprentice, may be sued for damages on his covenant if the apprentice absconds or refuses to work (see cases of this kind in the *Printers' Register* for August, 1883, and November, 1899).

Apprentice's Wages.—When, as is usually the case now, the apprentice lives at home the master generally pays him wages. These vary according to his period of service. A common plan is to arrange to pay him so much a week in

his first year, so much more in his second year, so much more in his third, and so on as fixed wages, and where he is engaged on work that can be cast up to give him one-third of his earnings above a certain sum besides. For instance, if a boy's fixed wages are 7s. a week, it is usual to say he can have that and one-third of all that his earnings would cast up at after deducting 15s. Thus, if he earned 21s. he would get 7s., plus one-third of 6s., or 2s., making 9s. in all.

When, by the indenture, an apprentice is to be paid so much a week, no exceptions being specified, the master is not entitled to make any deduction for days when the printing office is closed, nor when the apprentice is absent through illness.

Coming out of his Time.—When the apprentice has completed his term of apprenticeship he is entitled to the possession of his indenture, and it is satisfactory if the master endorses thereon a certificate that the service has been duly performed.

Technical Instruction.—In modern printing offices it often happens that an apprentice does not get fully instructed in the whole trade of a printer; indeed he often learns only some branch of the art. It is therefore very important that all apprentices should attend the classes in letterpress printing at one of the technical schools whenever this is possible, as it fortunately now is in London and all the larger provincial towns. Some masters, knowing that the attendance of their apprentices at these schools is beneficial to themselves as well as to the lads, allow them to attend the classes in working hours, and this should be the general rule, for in these times of dividing up trades into sections and departments it is almost the only way in which a youth can get an all-round knowledge of the business. But even if he has to devote his own time to these classes the apprentice should not fail to do so, and we strongly advise

him to go through the whole course, and not to confine himself exclusively to the branch of the trade to which he is apprenticed. He will also find it well worth his while to submit himself for examination by the City and Guilds of London Technical Institute, and to strive to gain the highest awards possible, but any certificate is better than none.

Bonuses to Apprentices.—Several of the large London printing houses are adopting the excellent plan, for many years pursued in Germany and France, of offering a certain sum of money, such as £20, as a bonus to apprentices who have conducted themselves satisfactorily during their period of servitude. Although this is essentially in the nature of a gift, we mention it here in order to commend the custom to employers. A sum like this ought to be of great value to the youth at that crisis of life when he is freed from servitude and becomes a journeyman. On the other hand, a lad who has done his best for his master's interests during his seven years' apprenticeship will have saved him much more than the amount named.

Limitation of Apprentices.—In all "Society" offices there is a limit set to the number of apprentices who may be employed. In the book, jobbing, and weekly newspaper offices of London the recognised proportion is one apprentice to three journeymen; but no apprentices are employed on the morning and evening newspapers. The limit varies in different provincial districts, but the following is generally followed: "No office shall be deemed fair where there is a greater number of apprentices than two, unless four members of the Society (journeymen) be regularly employed, when the number may be increased to three; but on no account shall any office have more." "No new establishment for a weekly or other newspaper shall be allowed to take an apprentice until such paper shall have been in existence twelve months."

CHAPTER CIII.

The Business of the Master Printer.—Necessity for Technical Knowledge and Supervision—On Purchasing Plant—Motors—Estimating and Charging—Legal Duties.

The chief concern of the Master Printer is, of course, to make a good living out of his business, though, if he be a man of spirit, this will by no means be his sole aim; he will always take care that the work which leaves his printing office is creditable to him, and that his workpeople have no cause to complain against him on the score either of treatment or of pay.

To manage a printing business successfully demands much knowledge and thorough business habits. In these days there is no margin for waste or carelessness; everything is calculated closely, and the man who cannot work economically will certainly fail in the long run; for, either his prices will be higher than those of his more skilled rivals—and thus work will not come to him—or, if he regulates his prices by theirs, the waste in his office will leave him little or no profit, if it does not entail upon him a loss.

A master printer, then, should have a thorough knowledge of the art in all its branches, so as to know at once how any kind of work can be accomplished most economically. He must be able to control his workmen, to know from their returns whether they are doing an adequate amount of work daily, and to make up his mind quickly whether to keep them or not. He must make himself well acquainted with the prices at which various kinds of printing are being done by other firms, and with the best markets for all goods

he has to buy, whether paper, ink, type, machinery, or material. He must know what to buy, and what to abstain from buying. He must be able to estimate beforehand, without material error, what any job offered to him will cost, so that if (as is most likely in these days) he has to quote a price, he may quote one low enough to bring him the work, and at the same time high enough to yield him a profit. To do all this he must work his office systematically, and, above all things, must have a right notion of the elements which combine to make up the cost of a job.

Purchasing Plant.—The judicious laying out of capital in plant is of the highest importance. The printer should take care that he gets full value for his money, not only by finding out the current market price of each article, but by buying only such things as are certain to be useful to him. Travellers and salesmen are persuasive—it is their business to sell; but the printer must always ask himself whether what is offered is wanted, and is really the best thing he can buy. Many a man has bought fount after fount of fancy type which has lain in its cases, unused, the greater part of the time it has been in the office.

In buying machinery it is economy to get the best, for the best lasts longest, requires fewest repairs, and turns out the best work. If only one cylinder machine can be bought at first, let it be a double-demy of a good maker. Second-hand machinery is always to be looked at suspiciously, though occasionally most serviceable plant can be bought second-hand.

So, too, with frames, cases, racks, imposing surfaces, and the like. Get good ones made of well-seasoned wood, and well constructed; such will last a lifetime, while cheap articles will probably warp and crack soon after being put to use.

The same thing is to be said of type. The cheap stuff sold by some small founders is generally cast in compara-

tively soft metal. It costs less at first than hard metal type, but it is not so cheap in the end, especially if you intend to turn out good work.

Lay in good-sized founts of the most useful book types; niggardliness in this respect often leads to loss while compositors stand waiting for sorts, or running about picking here and there.

Buy founts in series; if you have a long primer of a certain face, get the brevier to match it, and so forth, that when two or more are used together they will harmonise.

Be sure to have plenty of quads and spaces, leads, brass rule, furniture and quoins always available.

Of jobbing types, be extremely careful in your selection. When you have only a comparatively small sum to spend on them, beware of getting too many styles. It is vastly better, and more economical, to get adequate-sized founts of a few kinds than small founts of many kinds. Again, it is much best to buy a series of one style, and then a series of another.

Beware of anything outlandish in design. It may take with the public for a few weeks, but it soon gets altogether out of fashion, and is then fit for nothing but the metal pot. What numbers of ornaments brought out of recent years have become unusable long before they have worn out!

On the other hand, you must not be behind the times; if the public taste is decided for certain kinds of types, you must have them, or lose custom.

In the next chapter is given a selection of types which are recommended as the foundation of a well-equipped modern jobbing office. Such a selection will cost nearly £300, and it may be that the man who contemplates starting in a humble way in a small provincial or colonial town cannot afford to lay out so large a sum on type. We would advise such a man to cull from the faces suggested. Anyhow, he should have a good series of modern-face book letter,

from pica to nonpareil, roman and italic; the like of old style type, a series of De Vinne type, three or four series of sanserifs, down to pearl, some with lower case, a few founts of titling letter and of antique or clarendon, two or three useful black letter founts, a series of such faces as Miller's Old Style Antique, No. 2, and small founts of the larger sizes of ordinary old style roman and italic, such as Great Primer, Two-line Pica, etc., for these make most effective jobbing types when tastefully handled. Such a selection will do to begin upon in a small way, but the variety of founts must be increased as money is found available for the purpose. If even this is too large for the funds at disposal, it should be remembered that excellent work can be turned out with nothing more than old style and De Vinne, or modern-face book letter and sanserifs.

It is indispensable that the jobbing printer should have one or more treadle platen machines. If only one can at first be purchased, let it be a foolscap folio, with good rolling arrangements; when work increases, a demy folio to run by power will be a most useful addition.

For all but the largest printing offices, gas or electric engines are the best motors; they require little looking after, and can be started and stopped just when required. Be sure to get a good engine when you buy one, and do not be persuaded into making experiments with untried motors. Always, too, get a motor which will not only run your present machinery with ease, but have power to spare, so that some additional machines can be worked by it when they are put down.

Should the printer about to start on his own account contemplate getting plant on the hire-purchase system, let him be careful to deal with a firm which is not likely to be too strict with him should he find it necessary to ask indulgence, and let him not contract to make periodical payments of sums that will be beyond his power. It is to

be remembered that all these payments have to come out of profit, and after the printer has thereout paid his rent and supported himself and his family. The hire-purchase system is often very useful for the acquirement of a new machine, but starting a printing office entirely or even largely by its aid is to be deprecated, for it loads a man with a burden often too heavy for him to bear.

Estimating and Charging.—These are most important duties of a master printer, and upon his skill in performing them his well-being will greatly depend. He must know all about cost, and omit nothing that enters into it. Here it is where so many printers fall into error. They remember well the cost of wages of compositor and pressman, the value of paper, and the like, but they ignore such matters as interest on capital, wear and tear of machinery and material, the wages of readers, warehousemen, and clerks, rent and taxes, gas consumed, and similar items; while not infrequently ink itself is looked upon as a trifle not worth reckoning. Men who ignore these things, and put some 20 per cent. upon what they are pleased to think the cost of a job, wake up some day and find themselves the possessors of a worn-out plant, and lacking the funds to replace it; if, indeed, insolvency does not sooner come upon them. Let the master printer remember that he has to get out of his business, not only a return for his own services, and interest upon the capital he invests in it, but that capital back from time to time, in order that it may be used again in replacing the plant and material worn out or consumed. The only way to be sure of doing this is to take care that every job pays its share of the general standing charges of the concern, and a profit adequate to cover all incidentals and yield a net amount for the printer's own pocket. Things must not be done by guess-work. The cost of paper, for instance, should, with the aid of tables or ready reckoners, be accurately put down, and when

coloured inks are to be used, their cost cannot be too closely looked into. Some, and especially good reds, are very expensive, and it is highly dangerous to "throw in" the ink without calculation.

This very important subject of estimating has been dealt with in the next chapter but one by a master printer of much experience, and a perusal of the subsequent chapter on bookkeeping will afford some additional hints. The cost book, of which a specimen page is there given, if kept properly, will materially aid the printer in arriving at a just conclusion as to the cost of a job, and indicate the price he ought to charge for it.

Of course, when a man has gained experience, he will in many cases be able to say offhand what price is to be charged for an ordinary job, without going through the process of making calculations; but when there is any doubt, it is well to figure out the matter.

We need hardly remind the reader of the wise saying of Poor Richard (Benjamin Franklin), himself a printer, that the eye of the master will generally earn more for him than his hands. The obvious meaning of this is that he must be always on the look out to see that all his workpeople earn their wages fully, and that there is no waste anywhere.

Legal Duties.—A few words as to the duties imposed by law on those who carry on the business of a printer may prove useful.

In England no leave of any office of State or municipality has to be obtained for the establishment of a printing office: every person who pleases may set up one, and no registration of it is necessary; but as every printing office is a factory within the meaning of the Factory Acts, before starting work the printer should put himself in communication with the factory inspector for his district and obtain from him (or from Messrs. Shaw & Sons, of Fetter Lane, E.C., for 3d.) an Abstract of the provisions of the Factory Acts

relating to non-textile factories. The blanks on this must be duly filled up, and then it must be stuck up in a conspicuous place in the office. Before pasting it up the printer will do well to read it carefully and mark what the Acts require of him. He will find that he is restricted in the employment of children (under 14), "young persons" (14 to 18 years of age), and women; that he must keep his premises clean, properly ventilated and warmed, and must not overcrowd them; that shafting, straps, and all the dangerous parts of every machine must be fenced so as to render them as safe as possible; that he must keep certain registers and give notice whenever an accident occurs or a new child or young person is taken on.

Should he start a newspaper he must register it in the office of the Registrar of Joint-Stock Companies at Somerset House, London, as required by the Newspaper Act of 1881.

The only other legal requirements are that he should print his name and address upon every job that issues from his press (with few exceptions[1]), and that he should file and keep a copy of every such job. The addition of the printer's name and address (technically called "the Imprint") is frequently omitted, but the want of it is sometimes of great moment. Not long ago a customer successfully resisted the printer's claim for payment on the ground that the imprint was wanting, and this although he himself had required that it should be omitted. And as regards electioneering printing, a printer who omits his imprint thereon may find himself subject to severe penalties.

[1] The exceptions are: Impressions of engravings, address cards, business cards, price lists, lists or catalogues of goods dealt in or for sale, catalogues of estates for sale and the like, bank notes, bills of exchange, promissory notes, bonds or securities for the payment of money, bills of lading, policies of insurance, letters of attorney, deeds, agreements, transfers or assignments of stocks or shares, receipts, law proceedings, and papers printed by authority of Parliament or of any public board or office.

These pitfalls being avoided, there are yet others against which the master printer will always have to guard. One is that he should print nothing libellous, and another is that he should infringe no man's copyright. If he should do either he may incur legal proceedings to which it will be no defence that he was simply carrying out his customers' orders. Seeing that in the case of infringement of copyright in a picture or design a penalty is imposed for every copy issued, the inadvertent use of a process block or engraving produced from a copyright photograph or drawing may, in the case of large numbers being printed, involve the printer in ruin. In a recent case a penalty of a farthing a copy amounted to considerably more than £2,000, and then there were the costs to pay.

Stock-Taking.—It is essential that a master printer should periodically ascertain the results of his trading, whether he is making a profit or a loss, and to what extent, and what are his liabilities and his assets. He should do this at least once a year and preferably every half-year, and in order to arrive at a true conclusion he must keep the right sort of accounts in the proper way, and enter up everything accurately and systematically, as recommended in Chapter CVI.

CHAPTER CIV.

The Selection of Type Plant for Job Work.[1]

In selecting his type plant the modern job printer would, as far as possible, avail himself of the advantages of the Point System. All the British type-founders who prominently identify themselves with the requirements of modern job work will furnish what may be termed the "essential founts" on that system. He would also have his leads and brass rules on that system. Whether he will be able to dispense entirely with Great Primer, Double Pica, 2-line English, and 2-line Great Primer—having in mind the plain faces—is at least doubtful. It would be possible if he had all Great Primer faces on 18-point body; Double Pica on 24-point body; 2-line English on 30-point body; and 2-line Great Primer on 36-point body. But although it may be the full determination in selecting type plant to adhere to the Point System, circumstances may arise to upset the best calculation, and one or more of the sizes named may have to make its appearance. Hence, bodies that are not on the Point System will, in a few instances, be found in the basis of selection that we here lay down.

Neither is it necessary to preclude the introduction of border, rule, and spaces on the Didot Point System (of which Cicero is the standard body), but the material on the two standards should be kept distinctly arranged.

The type plant of a jobbing office might very well be put

[1] This chapter is by Mr. George Joyner.

under two heads. One portion would come under the category of "essentials," and the other under that of "caprices." Perhaps the terms hardly need explanation. The "essentials" are the founts of comparatively plain character that are suitable to form the basis of all display work, and in many instances the whole structure. Embellishment that finds general acceptance may be included. The "caprices" are the founts of fanciful design, selected because they suit the whim of the printer or the client—founts that may occasionally be used with good effect, but somehow are more often inappropriately "dragged in"; and the embellishment of definite characteristics that can only be well applied in special work. In some type plants the "caprices" decidedly preponderate. The most successful job-printing businesses have, however, been built up by those masters who, possessing sound taste, have also sufficient knowledge of the characteristics of type faces to enable them to influence clients in the matter of style.

We propose confining ourselves to the essentials of a comparatively small jobbing type plant, merely laying down a basis that may be augmented according to circumstances, leaving "fancy" material to individual predilection.

By the exercise of taste on the part of the compositor it is remarkable what can be achieved in the modern arrangement of display without the use of either "fancy," very condensed, or very expanded type faces.

Selecting in series is a sound principle. When not able to afford all the sizes of a series get as many as possible, and add the others as opportunity offers.

If law, corporation, or auction job work were, prospectively, to form a chief feature of the department, it would be advisable to substitute body founts of modern face for the Old Styles in the following list; and a series of Antique would probably be found more suitable than the "Jenson" face.

Body Founts.

50 lb. (6-point) Nonpareil O. S. at 2s. 2d., £5 8s. 4d.; 120 lb. (8-point) Brevier O. S. at 1s. 5d., £8 10s.; 120 lb. (10-point) Long Primer O. S. at 1s. 3d., £7 10s.; 70 lb. (12-point) Pica O. S. at 1s. 3d., £4 7s. 6d. Total, £25 15s. 10d.

It is to the advantage of the purchaser, to the extent of 2d. per lb., if he can commence all his body founts with not less than 120 lb. of each. Each of the above should include a fount of italic, ordinary accents, braces, two, three, and four em metal rules, fractions, spaces, and quads.

For *Circulars*, *Booklets*, and *General Work:* a complete series of either or all of the following:—

Jenson (or Venetian) Old Style Series.

10 lb. (6-point) Nonpareil at 3s. 3d., £1 12s. 6d.; 25 lb. (8-point) Brevier at 2s. 2d., £2 14s. 2d.; 30 lb. (10-point) Long Primer at 1s. 10d., £2 15s.; 30 lb. (12-point) Pica at 1s. 6d., £2 5s.; 20 lb. Great Primer at 1s. 2d., £1 3s. 4d.; 20 lb. (18-point) 3-line Nonpareil at 1s. 2d., £1 3s. 4d.; 20 lb. (24-point) 2-line Pica at 1s. 1d., £1 1s. 8d.; 20 lb. (30-point) 5-line Nonpareil at 1s. 1d., £1 1s. 8d.; 22 lb. (36-point) 3-line Pica at 1s. 1d., £1 3s. 10d.; 25 lb. (48-point) 4-line Pica at 1s., £1 5s. Total, £16 5s. 10d.

Gallic (or French) Old Style Series.

10 lb. (6-point) Nonpareil at 3s. 3d., £1 12s. 6d.; 25 lb. (8-point) Brevier at 2s. 2d., £2 14s. 2d.; 30 lb. (10-point) Long Primer at 1s. 10d., £2 15s.; 30 lb. (12-point) Pica at 1s. 6d., £2 5s.; 20 lb. (18-point) 3-line Nonpareil at 1s. 2d., £1 3s. 4d.; 20 lb. (24-point) 2-line Pica at 1s. 1d., £1 1s. 8d.; 20 lb. (30-point) 5-line Nonpareil at 1s. 1d., £1 1s. 8d.; 22 lb. (36-point) 3-line Pica at 1s. 1d., £1 3s. 10d.; 25 lb. (48-point) 4-line Pica at 1s., £1 5s. Total, £15 2s. 2d.

"Haddonian" Old Style Series.

5 lb. (6-point) Nonpareil at 3s. 3d., 16s. 3d.; 8 lb. (8-point) Brevier at 2s. 2d., 17s. 4d.; 11 lb. (10-point) Long Primer at 1s. 10d., £1 0s. 2d.; 13 lb. (12-point) Pica at 1s. 6d., 19s. 6d.; 16 lb. (18-point) 3-line Nonpareil at 1s. 2d., 18s. 8d.; 20 lb. (24-point) 2-line Pica at 1s. 1d., £1 1s. 8d.; 22 lb. (36-point) 3-line Pica at 1s. 1d., £1 3s. 10d.; 25 lb. (48-point) 4-line Pica at 1s., £1 5s. Total, £8 2s. 5d.

In this series we have given the quantities advertised by the founders. Italics in the "Haddonian" series are also available, and are supplied in founts of just about half the strength of the foregoing. The "Flemish" face is practically identical with the "Haddonian" face. If either of these faces was selected in addition to the founts of "Jenson" and "Gallic," the "Haddonian" scale or the following would be sufficient for a small plant :—

Flemish Old Style Series.

7 lb. (6-point) Nonpareil at 3s. 3d., £1 2s. 9d.; 20 lb. (8-point) Brevier at 2s. 2d., £2 3s. 4d.; 25 lb. (10-point) Long Primer at 1s. 10d., £2 5s. 10d.; 25 lb. (12-point) Pica at 1s. 6d., £1 17s. 6d.; 14 lb. (18-point) 3-line Nonpareil at 1s. 2d., 16s. 4d.; 12 lb. (24-point) 2-line Pica at 1s. 1d., 13s.; 16 lb. (30-point) 5-line Nonpareil at 1s. 1d., 17s. 4d.; 18 lb. (36-point) 3-line Pica at 1s. 1d., 19s. 6d.; 20 lb. (48-point) 4-line Pica at 1s., £1. Total, £11 15s. 7d.

Also to work in conjunction with all of the above series a complete range of two styles of "Blacks" or Texts: say Venetian Text for that of a somewhat condensed character, and Tudor Black or the "Satanic" for that of a broader face.

Venetian Text Series.

5 lb. (8-point) Brevier at 4s., £1; 6 lb. (10-point) Long Primer at 3s., 18s.; 10 lb. (12-point) Pica at 2s. 6d., £1 5s.; 10 lb. (18-point) 3-line Nonpareil at 2s., £1; 10 lb. (24-point) 2-line Pica at 1s. 9d., 17s. 6d.; 10 lb. (30-point) 5-line Nonpareil at 1s. 9d., 17s. 6d.; 12 lb. (36-point) 3-line Pica at 1s. 9d., £1 1s.; 18 lb. (48-point) 4-line Pica at 1s. 6d., £1 7s.; 28 lb. (60-point) 5-line Pica at 1s. 6d., £2 2s. Total, £10 8s.

Tudor Black Series.

3 lb. Nonpareil at 5s., 15s.; 4 lb. Brevier at 4s., 16s.; 5 lb. Long Primer at 3s., 15s.; 7 lb. Pica at 2s. 6d., 17s. 6d.; 9 lb. Great Primer at 2s., 18s.; 10 lb. Double Pica at 2s., £1; 10 lb. 2-line English at 1s. 9d., 17s. 6d.; 15 lb. 2-line Great Primer at 1s. 9d., £1 6s. 3d.; 20 lb. 2-line Double Pica at 1s. 6d., £1 10s.; 24 lb. 4-line Pica at 1s. 6d., £1 16s.; 28 lb. 6-line Pica at 1s. 2d., £1 16s. 8d. Total, £12 7s. 11d.

"Satanic" Series.

3 lb. (6-point) Nonpareil at 4s. 6d., 13s. 6d.; 4 lb. (8-point) Brevier at 4s., 16s.; 5 lb. (10-point) Long Primer at 3s. 3d., 16s. 3d.; 7 lb. (12-point) Pica at 3s., £1 1s.; 9 lb. (18-point) 3-line Nonpareil at 2s. 9d., £1 4s. 9d.; 9 lb. (24-point) 2-line Pica at 2s. 6d., £1 2s. 6d.; 9 lb. (36-point) 3-line Pica at 2s. 3d., £1 0s. 3d.; 15 lb. (48-point) 4-line Pica at 2s. 1d., £1 11s. 3d.; 24 lb. (60-point) 5-line Pica at 2s., £2 8s.; 24 lb. (72-point) 6-line Pica at 2s., £2 8s. Total, £13 1s. 6d.

For *Cards, Noteheads, Letterheads, etc.*, not less than three sizes of Script.

Script Series.

7 lb. 2-line Pica at 3s. 6d., £1 4s. 6d.; 8 lb. 3-line Pica at 3s. 6d., £1 8s.; 10 lb. 4-line Pica at 3s., £1 10s. Total, £4 2s. 6d.

(Each to have spaces included if required.)

For *Advertisement and Display Work generally*, the following series are almost indispensable. If "Regina," "Quill Pen," or other bold-faced italic be selected the De Vinne italic series could very well be omitted until it became desirable to make the range more comprehensive.

"Regina" Series.

4 lb. Long Primer at 4s., 16s.; 6 lb. Pica at 3s. 9d., £1 2s. 6d.; 8 lb. English at 3s. 8d., £1 9s. 4d.; 9 lb. 3-line Nonpareil at 3s. 6d., £1 12s. 4d.; 9 lb. 2-line Pica at 3s. 3d., £1 9s. 3d.; 10 lb. 5-line Nonpareil at 3s. 2d., £1 11s. 8d.; 12 lb. 3-line Pica at 3s., £1 16s.; 17 lb. 4-line Pica at 2s. 9d., £2 6s. 9d.; 24 lb. 5-line Pica at 2s. 8d., £3 4s.; 25 lb. 6-line Pica at 2s. 6d., £3 2s. 6d.; 30 lb. 8-line Pica at 2s. 3d., £3 7s. 6d. Total, £21 17s. 10d.

"Quill Pen" Series.

14 lb. Great Primer at 2s., £1 8s.; 16 lb. Double Pica at 2s., £1 12s.; 18 lb. 2-line English at 1s. 9d., £1 11s. 6d.; 20 lb. 2-line Great Primer at 1s. 9d., £1 15s.; 20 lb. 2-line Double Pica at 1s. 6d., £1 10s.; 25 lb. 4-line Pica at 1s. 6d., £1 17s. 6d.; 25 lb. 5-line Pica at 1s. 6d., £1 17s. 6d. Total, £11 11s. 6d.

De Vinne Condensed Series.

6 lb. Nonpareil at 3s. 3d., 19s. 6d.; 9 lb. Brevier at 2s. 2d., 19s. 6d.; 12 lb. Long Primer at 1s. 10d., £1 2s.; 14 lb. Pica at 1s. 6d., £1 1s.; 16 lb. Great Primer at 1s. 2d., 18s. 8d.; 18 lb. 2-line Pica at 1s. 1d., 19s. 6d.; 20 lb. 2-line English at 1s. 1d., £1 1s. 8d.; 20 lb. 2-line Great Primer at 1s. 1d., £1 1s. 8d.; 22 lb. Canon at 1s., £1 2s.; 26 lb. 4-line Pica at 1s., £1 6s.; 26 lb. 5-line Pica at 1s., £1 6s. Total, £11 17s. 6d.

De Vinne Square Series.

6 lb. Nonpareil at 3s. 3d., 19s. 6d.; 9 lb. Brevier at 2s. 2d., 19s. 6d.; 12 lb. Long Primer at 1s. 10d., £1 2s.; 14 lb. Pica at 1s. 6d., £1 1s.; 16 lb. English Face at 1s. 4d., £1 1s. 4d.; 16 lb. Great Primer at 1s. 2d., 18s. 8d.; 18 lb. 2-line Pica at 1s. 1d., 19s. 6d.; 20 lb. 2-line English at 1s. 1d., £1 1s. 8d.; 20 lb. 2-line Great Primer at 1s. 1d., £1 1s. 8d.; 24 lb. Canon at 1s., £1 4s.; 26 lb. 4-line Pica at 1s., £1 6s.; 27 lb. 5-line Pica at 1s., £1 7s. Total, £13 3s. 10d.

De Vinne Italic Series.

3 lb. Nonpareil at 5s., 15s.; 4 lb. Brevier at 4s., 16s.; 5 lb. Long Primer at 3s., 15s.; 6 lb. Pica at 2s. 6d., 15s.; 10 lb. Great Primer at 2s., £1; 12 lb. 2-line Pica at 1s. 9d., £1 1s.; 14 lb. 2-line Great Primer at 1s. 9d., £1 4s. 6d.; 15 lb. Canon at 1s. 6d., £1 2s. 6d. Total, £7 9s.

Lining Sans (or Gothic) Series.

Five sizes on (6-point) Nonpareil body, *viz.:* 2 lb. No. 1 at 5s., 10s.; 2½ lb. No. 2 at 5s., 12s. 6d.; 2½ lb. No. 3 at 5s., 12s. 6d.; 3 lb. No. 4 at 5s., 15s.; 3½ lb. No. 5 at 5s., 17s. 6d.; 4 lb. Brevier at 4s., 16s.; 6 lb. Long Primer at 3s., 18s.; 8 lb. Pica at 2s. 6d., £1; 12 lb. 3-line Nonpareil at 2s., £1 4s.; 16 lb. Double Pica at 2s., £1 12s.; 20 lb. 2-line Pica at 1s. 9d., £1 15s.; 24 lb. 2-line Great Primer at 1s. 9d., £2 2s. Total, £12 14s. 6d.

Condensed Sans Series (with Lower Case).

8½ lb. Brevier at 4s., £1 14s.; 10½ lb. Long Primer at 3s. 6d., £1 16s. 9d.; 12 lb. Pica at 3s., £1 16s.; 14 lb. Great Primer at 2s., £1 8s.; 16 lb. 3-line Nonpareil at 2s., £1 12s.; 18 lb. Double Pica at 2s., £1 16s.; 20 lb. 2-line Pica at 1s. 9d., £1 15s.; 22 lb. 5-line Nonpareil at 1s. 9d., £1 18s.; 24 lb. 2-line Great Primer at 1s. 9d., £2 2s.; 30 lb. 3-line Pica at 1s. 9d., £2 12s. 6d.; 40 lb. 4-line Pica at 1s. 6d., £3. Total, £21 10s. 3d.

In addition to the ordinary amount of quads and spaces the following would probably be found necessary in practice:—

Extra Quads and Spaces.

10 lb. Nonpareil Spaces at 2s. 2d., £1 1s. 8d.; 20 lb. Nonpareil Quads at 1s., £1; 15 lb. Brevier Spaces at 1s. 7d., £1 3s. 9d.; 30 lb. Brevier Quads at 9d., £1 2s. 6d.; 20 lb. Long Primer Spaces at 1s. 5d., £1 8s. 4d.; 50 lb. Long Primer Quads at 7d., £1 9s. 2d.; 20 lb. Pica Spaces at 1s. 3d., £1 5s.; 50 lb. Pica Quads at 6d., £1 5s. Total, £9 13s. 5d.

Initials.

Two complete sets of initials, say, about 8-line, from £2 to £2 10s., and 4-line at £1 5s. Total, say £3 10s.

Brass Rule.

8-to-pica fine line (Scale 3), £2 5s.; 8-to-pica medium face (1 set with mitres for corners), 13s.; 4-to-pica double medium (1 set with mitres for corners), £1 2s.; 4-to-pica thick rule (1 set with mitres for corners), £1 2s. Total, £5 2s.

The supply of leads, clumps, quotations, and metal furniture should be on the most liberal scale possible. With ample whiting-out material, composition is expedited to a very appreciable degree.

For *Certificates, etc.*, one border of large calibre, such as the "Teutonia," "Holbein," or "Rubens," is well-nigh indispensable in a modern plant. One fount each of Parts I., II., and III. of the "Rubens" costs £5; and this being on Cicero body, would require one or two sets of brass rule on the same standard to work in combination.

The two following series probably rank as the most useful to add to the foregoing; the first because it is an extended face, and the second as affording relief—most of the series we have named being characterised by strength of face.

Old Style Extended Series (with Lower Case).

7 lb. Brevier at 1s. 2d., 15s. 2d.; 10 lb. Long Primer at 1s. 10d., 18s. 4d.; 12 lb. Pica at 1s. 6d., 18s.; 20 lb. Great Primer at 1s. 2d., £1 3s. 4d.; 30 lb. 2-line Pica at 1s. 1d., £1 12s. 6d.; 30 lb. 3-line Pica at 1s. 1d., £1 12s. 6d.; 35 lb. 4-line Pica at 1s., £1 15s. Total, £8 14s. 10d.

"Athenian" Series.

Three sizes on Nonpareil body, *viz.:* 2½ lb. No. 1 at 6s., 15s.; 3 lb. No. 2 at 5s., 15s.; 3½ lb. No. 3 at 5s., 17s. 6d.; and caps and small caps to each of the following five sizes, *viz.:* 5 lb. Brevier at 4s., £1; 7 lb. Long Primer at 3s., £1 1s.; 12 lb. Great Primer at 2s., £1 4s.; 14 lb. 2-line Pica at 1s. 9d., £1 4s. 6d.; 16 lb. 2-line English at 1s. 9d., £1 8s. Total, £8 5s.

If it is intended to do *Poster work* the following will be found to form a very good basis of equipment for posters of all ordinary descriptions:—

Series of Condensed Sans.

15 dozen 8-line, including lower case and figures, at 1s. 9d., £1 6s. 3d.; 15 dozen 12-line, including lower case and figures, at 2s., £1 10s.; 18 dozen 16-line, including lower case and figures, at 2s. 6d., £2 5s.; 10 dozen 20-line, caps and figures only, at 3s., £1 10s.; 10 dozen 26-line, caps and figures only, at 4s., £2; 5½ dozen 36-line, caps and figures only, at 5s. 6d., £1 10s. 3d. Total, £10 1s. 6d.

Elongated Latin (with Lower Case and Figures).

18 dozen 6-line at 2s. 6d., £2 5s.; 15 dozen 10-line at 2s. 9d., £2 1s. 3d.; 13 dozen 14-line at 3s. 3d., £2 2s. 3d. Total, £6 8s. 6d.

Series of Egyptian (all with Figures).

16 dozen 5-line at 1s. 9d., £1 8s.; 12 dozen 8-line at 1s. 9d., £1 1s.; 10 dozen 12-line at 2s., £1; 10 dozen 18-line at 3s., £1 10s.; 8 dozen 22-line at 3s. 6d., £1 8s.; 8 dozen 30-line at 4s. 6d., £1 16s. Total, £8 3s.

Series of De Vinne Condensed.

20 dozen 6-line, including lower case and figures, at 2s. 6d., £2 10s.; 25 dozen 8-line, including lower case and figures, at 2s. 6d., £3 2s. 6d.; 16 dozen 10-line, including lower case and figures, at 2s. 9d., £2 4s.;

16 dozen 12-line, including lower case and figures, at 3s., £2 8s.; 8 dozen 16-line, caps only, at 3s. 6d., £1 8s.; 5½ dozen 20-line, caps only, at 4s. 3d., £1 3s. 4d.; 5½ dozen 26-line, caps only, at 5s., £1 7s. 6d. Total, £14 3s. 4d.

SERIES OF SCRIPT.

15 dozen 6-line at 3s. 6d., £2 12s. 6d.; 15 dozen 8-line at 3s. 6d., £2 12s. 6d.; 15 dozen 12-line at 4s. 3d., £3 3s. 9d.; 3 dozen spaces to each of above at 9d., 6s. 9d.; 13 dozen 20-line at 5s. 6d., £3 11s. 6d.; 13 dozen 26-line at 7s., £4 11s.; 3 dozen spaces to each at 1s., 6s. Total, £17 4s.

Two sets of border rule: 6-line for double crown and upwards, 2-line for folio or crown. 10 feet of 6-line at 2s. 6d., £1 5s.; 10 feet of 2-line at 1s. 8d., 16s. 8d. Total, £2 1s. 8d.

Generally two strong founts of metal letter are indispensable in poster work, such as Great Primer and 2-line English, or Double Pica and 2-line Great Primer. Antiques are best for these; say:—

120 lb. Great Primer Antique at 1s. 1d., £6 10s.; 120 lb. 2-line English Antique at 1s., £6. Total, £12 10s.

If this scale is too extensive we should suggest increasing the Great Primer and 2-line English De Vinne founts as follows:—

50 lb. Great Primer De Vinne at 1s. 2d., £2 18s. 4d.; 60 lb. 2-line English De Vinne at 1s. 1d., £3 5s. Total, £6 1s. 4d.

It will be seen that selections of type such as above suggested will cost some £330; that is, £260 for the Jobbing type and £70 12s. for the Poster type.

One word in conclusion. It is not put forward by the writer that the above is necessarily the best selection of faces which could be made, or that variations to suit individual tastes or requirements should not often be made, but it embodies his own ideas on a subject to which he has devoted some attention.

The natures of many of the series named will be familiar

to readers of Chapter V. (in Vol. I.), but to show what the others are like these specimens are appended:—

HADDONIAN.

...This is Pica "Venetian Text."

Tudor Black.

This is Pica of "Satanic" Series.

This is "Regina," Pica and 3-Nonpareil.

Quill Pen.

Old Style Extended.

ATHENIAN.

CHAPTER CV.

ESTIMATING.[1]

It will be safe to assert that no part of a printer's business requires more judgment than that of estimating, and only those who have gained their knowledge in the school of experience are really competent to undertake such work. That a great many incompetent persons do undertake it is painfully evident by the extraordinary prices that often obtain.

Whilst no fixed rules can be laid down, yet the young printer who aspires to be either a master printer, foreman, or estimate clerk, will do well to understand that there are certain items which must always be taken into account, however varying the conditions of the printing office, and the oversight of any of these may turn the supposed profit into a loss. Even printers of long standing occasionally omit something important in their calculations because they unnecessarily burden their memories. A gentleman of the writer's acquaintance gave an estimate for a catalogue running into a considerable sum, and great was his surprise on the completion of the work, when comparing the actual with the estimated cost, to find that he had taken no account of the paper! The result was a heavy loss on the work, as the customer declined to go beyond the price that was given. Now, had that gentleman kept, as he should have done, either on the counterfoil of his estimate book, or on a slip of paper to be attached to the counterfoil, something of the following, such an error never could have occurred:—

[1] This chapter is by Mr. J. T. Cooper (of Cooper & Budd, Limited).

ESTIMATED COST SHEET.

To be attached to Estimate Counterfoil.

Name ______________________________

Description ______________________________

Quantity :

Composition . . .				
Electros or Stereos .				
Proofs, etc. . . .				
Paper				
,, Cover . . .				
Ruling				
Machining . . .				
Ink				
Litho				
Binding				
Folding, etc. . . .				
Numbering . . .				
Perforating . . .				
Warehouse . . .				

Remarks ______________________________

Composition.—This is naturally the first matter for consideration in computing the cost. But what for convenience is termed composition embraces more than the work of the compositor, and this with the inexperienced estimator is apt to be entirely overlooked. To be added to the actual composition is the work of the reader and the foreman, and the distribution of type is of course also included. Where it is straightforward bookwork, which can be set on piece according to the recognised scale at so much per thousand, to ascertain the cost is comparatively easy. It is in the miscellaneous work where the ability of the estimator comes into play. Suppose it be a 4to catalogue, containing some pages of display, others with blocks and tabular matter, requiring the cutting of the blocks for the type to be let in. How is the cost to be arrived at? Only by the knowledge of the estimator, acquired by careful observation of jobs that have for years passed through his hands. No system of measurement can be formulated that would here avail. There are many who have been engaged in the composing room for a great length of time on general work, who nevertheless are totally unable to cast off with any degree of accuracy the probable time a job will take. Indeed, it is surprising to find how far from the mark compositors frequently are. Nor is this failure confined to them; it is often to be seen in foremen also. The question arises, Why is it so? The answer is, because they are not men of observation in that particular. It is what makes an impression upon us that serves us on future occasions. A man may be a thoroughly up-to-date compositor, and yet be unable to tell the time a given job will take to compose. In such a case he has studied the styles of display that have come before him, and his eye has become so trained to what is symmetrical or otherwise that he can point out in an instant merits or defects. His mind has been impressed as the result of his study. But for estimating, his

faculties have not been called into exercise. It is not necessary for a man to be able to estimate the time that will be occupied in composing in order to be an efficient compositor, though this is useful; for a foreman it is certainly essential.

Distribution.—What would be a reasonable allowance for this (in which we include general clearing) can only really be learned by noticing how much time is spent throughout the year, and comparing it with that on composition. It is well worth looking into, as a good deal of misapprehension exists on this point, many printers accepting an average they have not tested, and consequently underrating it. It will be found to equal fully 25 per cent. of the compositor's total time, if care is bestowed upon the clearing, and everything is returned to its proper place.

Reading.—The amount to be added for this and the work of the foreman will vary in different offices according to the salary each receives, and the attention given to the reading. Whilst some houses are most particular, others are extremely lax—such things as spacing, punctuation, etc., receiving but scant attention. Taking an average, it would require about 20 per cent. addition on the work of the compositor, though some would allow no more than half that. It is, however, in the power of every printer to ascertain what his average is by keeping a record of his expenses and comparing them. By these means he will see at the end of a year what he has paid in wages to his compositors, and what to his reader and foreman, and he will then be able to fix his proportion exactly. This will give a basis to work upon. If he be in a small way, and does the reading and managing himself, he can set a reasonable value upon his services, and then compare it with the wages paid; or even when he does a certain amount of composition himself it would be no difficult task to approximate the time so spent.

Proofs.—These are important to bear in mind, and a fair percentage allowed. Customers vary considerably in their requirements, some being very exacting. The general public have no idea that it costs money to pull proofs. It should be stated in the estimate that author's corrections will entail an extra charge; for more disputes probably arise over corrections than anything else the printer has to deal with. Even where it has been so stated, yet customers who indulge heavily in alterations almost invariably think they have been at the mercy of the printer, and consequently overcharged. No doubt there have been delinquents in this respect, who have estimated low with the hope of making up on corrections. It is this unworthy practice which is responsible for the insertion in the tenders of public bodies and others that corrections are to be included: a system which is to be strongly deprecated, as the printer may not have the least idea of the expense he may incur, and more often than not the acceptance of such terms leads to bitter regrets.

Machining.—In ascertaining the cost of machining many things have to be taken into account. There is a tendency to under-estimate these—indeed, to ignore everything but the bare cost of labour. An instance came before us recently of a man who soberly endeavoured to show that he made some two hundred per cent. on cost! The work had been done by apprentices, and he had reckoned as his total cost the wages paid to them—some few shillings per week. When it came to be properly worked out his two hundred per cent. vanished almost to nothingness.

Another example is furnished in the specimen estimate of one of the teachers of typography. For a quad-demy machine he set out the price for man and boy at 10d. per hour, adding 25 per cent. for general expenses and 10 per cent. profit, making the total earning capacity of the machine about £3 per week, 45s. of which would have to be paid

in wages, leaving the munificent sum of 15s. for the proprietor, an amount that would not nearly pay expenses, much less leave a profit.

The following questions bearing on the cost of machining have been put to the writer:—

(1) What average time should be allowed to make-ready: a forme on a platen machine, with and without cuts; a double-crown poster; a double-demy forme of bookwork (adding for each square inch of cuts or process blocks)?

(2) What is the value per hour of the use of machines?

(3) What percentage should be deducted on an average from the full speed of the machine for stoppages?

(4) What is the average consumption of ink per thousand runs for formes of given sizes?

One answer may be given relative to all the above queries, *viz.*, that so much depends upon the circumstances and the nature of the work that it is impossible to fix any gauge which an inexperienced person could safely use. Many printers seem to be under the impression that it could be done, but a little consideration will show the difficulties that confront them.

Making-ready.—The time expended on this for any of the jobs specified above would be affected by the difference in paper, ink, the requirements of the customer, etc. A simple handbill might be made ready in a few minutes, whilst a circular in colours with close register, and ink to be matched, might take some hours. The time on a double-crown poster in black would vary according to the amount of wood letter it contained, and its condition—if worn, it would require underlaying. On an average it would take from a quarter to half an hour. The time spent on a forme of bookwork would largely depend upon the state of the type, and whether the sheets were to be pressed after printed. In many book houses it is still the custom to press or hot-

roll the work, in which case very little care is given to the make-ready. The time would be further affected if the machine had been running previously on the same kind of work. Supposing a man has three formes of 16 pp. demy 8vo following each other, the second and third would fall into the same position, and the make-ready would thus be a very small matter, that is assuming the type is in good condition. Whereas if formes of a totally different kind were interspersed between each it would materially add to the time. It would not be safe to calculate the making-ready of blocks by the square inch, as much rests with the detail of the picture and the quality of the engraving, the latter being a very important factor with process engravings.

Value per hour of the Machines.—In endeavouring to correctly estimate this, there are the following expenses to be borne in mind: rollers, brushes, oil, lye, make-ready paper, motive power, repairs, etc., nor must slack time be forgotten, which, unfortunately, happens in every office. It will, of course, be readily seen that the value per hour will be greater or smaller according to the size of the machine, if running on the same class of work. But in these days of advancement a large number of printers are caterers for work of the most diverse kind; so that while on one double-demy machine there may be running a forme of handbills, on another there may be a catalogue containing fine illustrations in colour, requiring a more skilled machinist at a higher wage, and the addition perhaps of a lad or girl to inset. Clearly, therefore, these two machines could not be fairly reckoned at the same cost. It is precisely so with platen machines, on which indeed the rate of wages so largely differs—from a few shillings to more than £2 per week. But to take as examples a double-demy cylinder and a demy folio platen on medium work, the cost has been worked out at 1s. 6d. per hour on the former, and 1s. per hour on the latter, which under ordinary conditions may be reasonable.

Deduction for Stoppages.—This, too, must be determined by circumstances. If the work be leaflets or cheap pamphlets from stereos the percentage should be small; on a double-demy or double-royal Wharfedale 10,000 copies per day should be produced. Where, however, it is a forme of type containing blocks, the progress may be seriously impeded by the rising of quads (which often baffle the most experienced men) and other causes. Again, if it be a superior job in colours, with a large number of half-tones, there will be need for constant cleaning, which may (and often does) reduce the output to considerably less than 5,000 copies per day.

Ink.—It is surprising how frequently this is passed by as an item too insignificant for notice. Yet the ink-maker's bill has to be paid. In small work, such as a few hundred 8vo circulars, the cost would be a mere trifle; but where the numbers are long, and the forme a solid one, with lines of heavy display letter, it becomes the printer to take careful note. Instances have come before us of those who make no difference in their charges between black and coloured inks, overlooking not only the additional cost, but the extra labour involved in cleaning. In one case an estimate had been given for 1,000 double-crown posters in blue; the customer afterwards decided to have it in red and blue, for which a further charge of only 3s. was made! Not nearly sufficient to pay for the extra ink. In another a very solid 4 pp. crown 4to, containing lines of wood letter, was estimated for red and black. The customer, after seeing a proof, wished the black to be replaced by bronze-blue, which he was informed would make no difference, and this on a run of 25,000!

In calculating the cost of ink much depends upon the paper and the openness or otherwise of the forme. As illustrating this we have two sheets of 8 pp. 4to before us, the number being 13,000 in both—one is a forme of light

display on a smooth paper, and in the other the pages are fairly solid, and the paper of an inferior quality—the former consuming less than half the quantity of the latter. A forme of 16 pp. demy 8vo ordinary bookwork on fair paper would consume about $\frac{1}{2}$ lb. of ink to the 1,000. It is not always economy to use a very cheap ink.

Paper.—In calculating the cost of this, care must be taken as to the number of sheets the reams contain, whether 480, 500, or 516, and due allowance made for spoils according to the work.

Binding, Folding, etc.—These, as a rule, are more easily ascertained than the work of the other departments, much of them being done on "piece," and in the large towns the majority of printers put them out to trade binders.

Warehouse: Cutting, Packing, etc.—Account must be taken of the labour involved in this department, and the cost of wrapping paper, string, wax, etc.

When the total costs of the different departments have been apportioned, then sufficient must be added to cover office and other outgoings, such as rent, rates, light, postage, cartage, advertising, and depreciation. These, as the other expenses, can only be known as proper accounts are kept, and the year's average ascertained. It is really a simple matter when once taken in hand; and it is surely more satisfactory to be working in the light than in the dark, so that weak points may be located and remedied. There is no need for elaboration. Necessarily the large office will require to enter into more details than the small one; and as a business grows, so modifications will be required.

There is all the difference between estimating the cost, and working it out after the job is completed. This latter is a very simple operation if account is kept of the expenditure as the work proceeds. It is well to check the actual with the estimated cost, as by this means not only is it seen whether they tally, but it forms a useful object lesson,

CHAPTER CVI.

BOOKKEEPING FOR PRINTERS.

BOOKKEEPING is a necessary outcome of the complicated relations of civilised life, and of the nature of modern trading. When men bartered goods for goods, or sold them for ready money, there was little need to record the transaction. Nor is there now any necessity for bookkeeping on the part of a workman who values his day's work at a certain sum, and receives that sum for it. But when credit is given or taken, or when a thing produced is the outcome of several men's labour, or of the use of machinery, it becomes advisable—nay, often quite necessary—to have a proper system of reckoning up the cost, and of comparing the expenses of the establishment with the revenue derived from it. Bookkeeping, then, arose almost simultaneously with the manufacturing and commercial systems, crude at first, but gradually improved, until now it may be said to be an almost perfect art.

There are two systems, or rather methods, of keeping accounts. One is called single entry and the other double entry. The latter alone is worthy to be called a system, for the former is little more than a mere record of transactions. Bookkeeping by double entry is the invention of the Venetians, the princes of commerce in the Middle Ages, and hence is often called the Italian system. Its great merit lies in the fact that it enables a trader to discover from time to time exactly how each item of revenue or expenditure affects himself.[1]

[1] By section 8 of the Bankruptcy Act, 1890, the Court is directed to suspend the discharge of a bankrupt for at least two years if,

The bookkeeping necessary for a printer is, and must be, somewhat extensive and complex. The reason is that his is a manufacturing business, and that he has to calculate the cost of the goods he sells, or of the work he does, by adding together many items of divers natures; whereas the ordinary shopkeeper has the information ready to his hand in the invoices of the manufacturer or warehouseman of whom he buys his stock. The stationer who sells a five-quire packet of note-paper for 1s. knows he makes a gross profit of 4d. on the transaction, because he paid the wholesale stationer for that same packet the sum of 8d.; but the printer who contracts to supply 10,000 handbills for 15s. cannot tell whether he will make a profit or loss on the job until he has estimated the time the composition, reading, correcting, machining, and warehousing will take, the cost of the paper and ink used, the wear and tear of type, machinery, and material, and the sums, if any, which he will have to spend on electros, stereos, or other such things, in order to produce the work required. It is so with all manufacturing businesses, and it is no use for the small printer to grumble that he is obliged to adopt a much more complicated system of bookkeeping than his friend the grocer, who turns over perhaps twice as much money in the course of a year. He must, in fact, keep the same kind of accounts as the grocer, and a good many others besides.

In bookkeeping by double entry, every transaction recorded is, either explicitly or implicitly, entered twice in the Ledger, once on the debit side and once on the credit side, and accounts are opened not only for every individual or firm who does business with the establishment, but also for the

among other things, he "has omitted to keep such books of account as are usual and proper in the business carried on by him, *and* as sufficiently disclose his business transactions and financial position within the three years immediately preceding his bankruptcy."

various departments of the establishment itself. Thus, if John Smith sells goods to the concern, an account is opened and headed "John Smith," and another account is opened and headed "Goods"; and if Smith sells £10 worth of goods to the concern, he is credited with £10 and "Goods" is debited with £10. "Goods" is thus treated as a fictitious person.

Everything the person or fictitious person whose name appears at the head of the account receives or gets the benefit of is *debited* to him or it, that is, the thing and its price or value are entered on the *left-hand* side of the account; and everything such person or fictitious person pays or gives out is *credited* to him or it, that is, the thing and its price or value are entered on the *right-hand* side of the account. There is one exception or special rule: discounts or allowances received by a person are entered on the credit side of his account and on the debit side of the "Discounts" account, and discounts given or allowances made by any person are entered on the debit side of his account, and on the credit side of the "Discounts" account.

Thus, if I sell £5 worth of goods to Jones, I debit Jones thus: "To goods, £5," and credit "Goods" thus: "By Jones, £5:" Jones has received the goods and "Goods" has given them out, that is why they are respectively debited and credited. So when Jones pays, taking 5s. discount, I credit him with £4 15s. cash and 5s. discount, and I debit "Cash" thus: "To Jones, £4 15s. 0d.," and debit "Discount" thus: "To Jones, 5s." Here Jones has paid £4 15s. and "Cash" has received that amount, and they are respectively credited and debited accordingly. Jones having received 5s. discount, is credited with it under the special rule, and "Discounts" is, under the same rule, debited with the like amount.

In all the above examples the double entries are apparent and explicit, but in business they are implicit. Thus, when goods are sold, every person to whom they are

sold is separately debited; but the crediting of "Goods" is left till the end of the week or month, and then the *total* of the sales is entered to the credit of the "Goods" account in the ledger: in this case the double entry is implicit, but it is as effectual as if it were made item by item.

This is the main principle of bookkeeping, and it is explained at length and various examples are given in all the books on the subject, one of the best of which is that of Hamilton & Ball, published by the Clarendon Press, Oxford (London: H. Frowde, Amen Corner, E.C.), at the reasonable price of 2s. The learner is strongly advised to get this book.

The books every printer ought to keep in his counting-house are: (1) a *Ledger*, (2) a *Cash Book*, (3) a *Bought Journal*, (4) an *Order Book*, (5) a *Cost Book*, (6) a *Day Book*. He will also find it very useful, if not absolutely necessary, to have printed *Dockets* of kinds to be specified. Entries in the Cash Book, Day Book, and Bought Journal are said to be "prime entries." It is from them that the entries are made in the Ledger, or as it is technically expressed, the Ledger is "posted."

The Ledger.—This book is familiar to every one. It contains the accounts of all persons with whom the firm has dealings, and each account has a debtor and a creditor side. Thus, if the firm sells goods on credit to John Smith, there must be an account in the Ledger headed "John Smith," and on the left hand, or debit, side must be entered "To goods (say), £4 12s. 6d." When Smith pays, the sum received must be entered on the credit side of his account, and if he is allowed any discount, that must also be entered on the same side. We will suppose Smith pays £4 8s., and is allowed 4s. 6d. discount. We shall enter on the credit side of his account (after placing the amounts in the Cash Book) these sums, and the account will stand thus:—

Dr.	JOHN SMITH.		*Cr.*
	£ s. d.		£ s. d
To Goods	4 12 6	By Cash	4 8 0
		„ Discount	0 4 6

and by adding it will be seen that both sides of the account are alike, or that the account "balances." It can therefore be ruled off, *i.e.*, double lines may be drawn under the totals of £4 12s. 6d. on each side of the account.

Again, if the firm buys goods on credit, it is necessary to open a similar account for the person from whom the purchase is made, and on the credit side of this account must be entered the amount of the goods so bought. The cash paid for them will be entered on the other, or debit side, and so will any discount allowed to the firm.

Accounts with persons or firms are called "Personal Accounts." Many tradesmen keep this kind of accounts only, and these certainly show how they stand with regard to those with whom they have dealings; but if they desire to know how their business stands with regard to themselves, and how much they gain or lose by it, they must keep in their Ledger another kind of account, called "Impersonal Accounts." These accounts are now enjoined by the section of the Bankruptcy Act already referred to. The accounts headed "Goods," "Cash," "Discounts," already referred to, are examples of impersonal accounts.

We have said printing is a manufacturing business, and therefore a somewhat complicated system of impersonal accounts is necessary.

Capital and Revenue.—One of the chief things necessary to be known by the bookkeeper in such a business is the distinction between capital and revenue, or, in other words, what items should be posted to the Profit and Loss account, and what should not. Ignorance on this point leads to erroneous and often disastrous results. On the

one hand, it is possible for a man to imagine his business far less remunerative than it really is; and on the other, the proprietor of an establishment may think himself prosperous, while all the time he may be faring very indifferently. The second error is, indeed, by far the more common, as it is certainly the more dangerous; the items omitted almost always belong to the debit or loss side of the revenue account, and they may be forgotten without any breach of faith on the part of a man to whom the proper principles of account-keeping are unknown.

To guard against errors of this sort, it is necessary to keep separate account of the leading items of expenditure. Accounts should be opened in the Ledger under each of the following heads: (1) Buildings, (2) Rent, rates, and taxes, (3) Machinery and standing plant, (4) Type, (5) Brass rule, leads, and furniture, (6) Consumable materials, (7) Wages, (8) Goods, (9) Casual expenses.

Buildings Account.—This account is necessary when part of the capital of the proprietor is expended in the erection or purchase of freehold or leasehold premises. The amount so expended is to be entered on the debit side of the account. In the case of leaseholds, purchased at a premium, a sum must every year (or half-year as the case may be) be written off for depreciation—that is to say, an amount must be entered on the credit side of the account, and a corresponding amount entered on the debit side of the Profit and Loss account. The amount of this depreciation will depend on the length of the lease. For instance, suppose a premium of £500 has been paid for a lease having fifteen years to run; it is obvious that this sum will be wholly sunk at the end of the fifteen years, and so a sum of £33 6s. 8d. must be written off every year in respect of this depreciation. Sums spent on repairs must be entered on the debit side of the account, and an annual sum equivalent to the average yearly cost of such

repairs written off (on the credit side), and carried to the debit side of the Profit and Loss account. When a lease has been bought the Buildings account will seldom be closed, and the balance of it will form an asset in the firm's balance sheet.

We subjoin two specimen Buildings accounts. In the first the printer is supposed to have bought a twenty-five years' lease at a premium of £500; in the second he is supposed to have paid nothing for the lease:—

BUILDINGS (SPECIMEN A).

Dr.		£	s.	d.	*Cr.*		£	s.	d.
1900.					1900.				
July.	*To Cash (Premium for lease)*	500	0	0	Dec. 31.	*By Profit and Loss*[1]— *Sinking Fund* (*b*)	10	5	0
,,	,, *Proctor, Costs of Assignment* . . .	12	10	0	,,	,, ,, . . . (*c*)	5	0	0
	(*a*)	512	10	0	,,	,, *B'l'nce carried down*	504	15	0
Oct.	,, *Abdy, for Repairs, etc.*	7	10	0					
		£520	0	0			£520	0	0
1901.					1901.				
Jan. 1.	*To Balance brot. down*	504	15	0	June 30.	*By Profit and Loss* . (*b*)	10	5	0
May	,, *Abdy, for Repairs* .	3	7	6	,,	,, ,, . (*c*)	5	0	0
					,,	,, *B'l'nce carried down*	492	17	6
		£508	2	6			£508	2	6
July 1.	*To Balance brot. down*	£492	17	6					

Note.—(*a*) is the total cost of the lease; (*b*) one-fiftieth part thereof, to be written off half-yearly as a sinking fund; (*c*) the estimated average half-yearly cost of repairs sometimes more and sometimes less than the actual cost.

BUILDINGS (SPECIMEN B).

Dr.		£	s.	d.	*Cr.*		£	s.	d.
1900.					1900.				
July.	*To Cook, for Repairs* .	8	15	0	Dec. 31.	*By Profit and Loss* .	15	0	0
Nov.	,, *Cash, for ditto* . .	6	5	0					
		£15	0	0			£15	0	0

Rent, Rates, and Taxes Account.—The name of this account explains what it is. Gas and water rates may be entered here, as well as rates and taxes properly so called. In it, on the debit side, must be entered each

[1] The reader will understand that wherever an entry By Profit and Loss appears on the credit side of an account, a corresponding sum is entered on the debit (Loss) side of the Profit and Loss account.

quarter's rent and each instalment of rate as it becomes due, the same items being also entered to the credit of the accounts of the several persons or bodies to whom they are payable; or if it is the invariable custom to pay rent and taxes as soon as they are due, the cash so paid may be posted direct from the Cash Book into the Rent and Taxes account (debit side), and thus no accounts need be opened to the landlord and the various creditors for rates. If any part of the premises is let off to tenants, the amount of the rent payable by them is posted to the credit side of this account, as well as to the debit of the tenants' accounts. The balance of the account is transferred every year (or half-year) to the debit side of the Profit and Loss account.

Subjoined is a specimen:—

RENT, RATES, AND TAXES.

Dr. 1900.		£	s.	d.	1900.		£	s.	d. *Cr.*
Sept. 29.	To *Munro, landlord, for Rent* .	30	0	0	Dec. 25.	By *Walker (sub-tenant)*	6	0	0
Oct.	„ *Cash, Poor Rate* .	7	12	0	„ 31.	„ *Profit and Loss* .	74	5	10
„	„ „ *Gas* . .	6	5	6					
„	„ „ *Water* . .	2	5	0					
„	„ „ *Queen's Taxes*	4	3	4					
Dec. 25.	„ *Munro, for Rent* .	30	0	0					
		£80	5	10			£80	5	10

Machinery and Standing Plant.—The account of these is kept in the same manner as the Buildings account. The cost of all machinery and standing plant is entered on the debit side of the Ledger, and every year a certain sum is written off for depreciation, *i.e.*, is entered on the credit side of this account and on the debit side of the Profit and Loss account. Seven per cent. on the prime cost of machinery and standing plant is a reasonable proportion to write off annually. By standing plant is meant frames, cases, racks, imposing surfaces, chases, galleys, and the like. The cost of repairs will go into the Casual Expenses account.

MACHINERY AND STANDING PLANT.

Dr.									*Cr.*
1900.		£	s.	d.	1900.		£	s.	d.
July.	*To Dawson (Dbl. Royal Wharf.)* . . .	220	0	0	Dec. 31.	*By Profit and Loss*, 3½ *p. c. on* £650 *for Depreciation* . .	22	15	0
„	„ *Payne (Dbl. Demy do.)*	180	0	0					
„	„ *Notting (s.h. Presses, etc.)*	46	0	0					
„	„ *Powell (2 Gordons)*	110	0	0					
„	„ „ *(Joinery, etc.)*	66	0	0	„	„ *B'l'nce carried down*	627	5	0
„	„ *Smith, Office Furniture*	28	0	0					
		£650	0	0			£650	0	0
1901.					1901.				
Jan. 1.	*To Balance brot. down*	627	5	0	June 31.	*By Profit and Loss*, 3½ *p. c. on* £678[1] . .	23	15	0
„ 25.	„ *Cook (s.h. Cropper)*	28	0	0	„	„ *B'l'ce carried down*	631	10	0
		£655	5	0			£655	5	0
July 1.	*To Balance brot. down*	£631	10	0					

Should a machine be sold, the Machinery account is to be credited with the price it fetches, and the purchaser debited with the like amount. Should, however, the sum at which it stands on the books be higher than such price, the Machinery account must be credited, and Profit and Loss debited, with such further sum as will make up the difference. Suppose, for instance, a machine bought for £100 in July, 1894, and sold at £45 in July, 1901. Seven per cent. having been written off annually, the machine would stand on the books at £100 less £49, or £51, in July, 1901. We must therefore make, on the credit side of the Machinery account, these entries: "By Smith (the purchaser), £45; by Profit and Loss, £6"; and we must enter to the debit of Smith's account: "To s.h. Machine, £45," and to the debit of the Profit and Loss account: "To Machinery—loss on sale of Machine, £6." The prime cost of this machine will, of course, now be deducted from the total on which the percentage for depreciation is to be calculated.

[1] The prime cost of the plant has been increased by the purchase of the second-hand Cropper, and therefore the percentage is calculated on the increased total. The reader must be cautioned that the percentage is not to be calculated on the balance of the account for the time being, but on the total prime cost of all.

Type, Brass Rule, Leads, and Furniture.—The accounts of these are kept in the same manner as that for machinery and standing plant, the only difference being in the amount to be written off annually for depreciation. On type of course it varies according to the wear it has. There are some very heavy jobs which require a new fount of type every ten or twelve months; while, on the other hand, in some small country offices type will last half a lifetime. In offices where a good amount of business is done, and the type is generally in use, 12 per cent. on the cost is a fair proportion to write off every year. A proper record should be kept of every fount of type, so that the owner may know when he purchased it and from whom. This is of great use when sorts are wanted, but it also enables him to know at what sum each fount stands valued at any time. Later on we will suggest the kind of book to keep for this purpose, but now we are dealing only with the Ledger, wherein such matters cannot be specified. Here is a specimen of the Type account in the Ledger:—

TYPE.

Dr.									*Cr.*
1900.		£	*s.*	*d.*	1900.		£	*s.*	*d.*
July.	*To Stephenson & Co.* .	86	5	0	Dec. 30.	*By Profit and Loss,*			
„	„ *Caslon*	32	7	6		6 % *on* £118 12*s.* 6*d.*	7	2	0
						„ *B'l'nce carried down*	111	10	6
		£118	12	6			£118	12	6
1901.					1901.				
Jan. 1.	*To Balance brot. down* .	111	10	6	June 30.	*By Profit and Loss,*			
„	„ *Miller & Richard* .	5	4	6		6 % *on* £125[1] . . .	7	10	0
„	„ *Reed & Sons* . .	1	3	0		„ *B'l'nce carried down*	110	8	0
		£117	18	0			£117	18	0
1901.									
July 1.	*To Balance brot. down*	£110	8	0					

When type is sold, the account is dealt with in the same way as the Machinery account is when a machine is disposed

[1] The prime cost of the type has been increased by the subsequent purchases, amounting to £6 7s. 6d. Here again the percentage written off is calculated on the total cost and not on the balance of the account for the time being.

of. Suppose a printer, who, having a fount of nonpareil, which cost him when new, seven years ago, 2s. 3d. per lb. net, sells it to his type-founder for old metal, and thus gets 3d. per lb. for it. If he has written off 12 per cent. per annum (or 84 per cent. for the seven years), his fount will stand in the Type account at the value of about 4½d. per lb. The difference between this and 3d. per lb. must be transferred to the Profit and Loss account, *i.e.*, entered on the credit side of the Type account and on the debit side of the Profit and Loss account, and the 3d. per lb. allowed by the type-founder will be entered to the debit of the type-founder's account and to the credit of the Type account. In this way the whole value of the fount will have been accounted for. Note should also be made in the Type record that the fount has been sold, and on future occasions the prime cost of the fount must be deducted from the sum on which the depreciation is to be calculated.

As regards brass rule, leads, and furniture, these are much shorter lived than type. They are cut up, lost, thrown into the pie-box, and generally wasted. It may be taken as a rule for most offices that very little remains of them five years after purchase, and therefore 20 per cent. on the cost is a proper sum to write off annually.

By some firms type, brass rule, and leads are treated together. This is done in a large London house that we are acquainted with, 15 per cent. on the whole being written off yearly.

Consumable Material.—This account requires to be treated quite differently. To the debit of the account is posted the cost of such things as coal, paper, ink, oil, roller composition, etc. At the end of the half-year stock must be taken of all these things,[1] and the value of those on hand must be

[1] Stock is taken by making an inventory of all the articles, and pricing them at their estimated values, which should never exceed cost price, and should generally be below it.

entered on the credit side of the account. The balance is transferred to Profit and Loss in the same way as that pointed out above, and the amount of the stock on hand is brought down on the debit side like the balance of an ordinary account.

CONSUMABLE MATERIAL.

Dr.		£	s.	d.		*Cr.*	£	s.	d.
1900.					1900.				
July.	*To Page, Coal*	35	0	0	Dec. 21.	*By Stock of Coal*	2	5	0
,,	,, *Fleming, Ink*	24	0	0	,,	,, ,, *Ink*	9	7	6
,,	,, *Parsons,* ,,	7	10	0	,,	,, ,, *Rollers and Composition*	4	0	0
,,	,, *Durable Co., Composition and rollers*	8	0	0	,,	,, *Paper*	256	0	0
,,	,, *Wrigley, Paper*	400	0	0	,,	,, *Sundries*	0	7	6
Aug.	,, *Spicer,* ,,	55	0	0					
,,	,, *Cash (Sundries)*	3	10	0		*Total Stock*	£272	0	0
						B'l'nce to Profit and Loss	261	0	0
		£533	0	0			£533	0	0
1901.									
Jan. 1.	*To Stock brought down*	£272	0	0					

Wages and Casual Expenses.—These two (separate) accounts are sufficiently explained by their titles. The sums paid are, of course, entered on the debit side, and at the end of the half-year the total is written off to Profit and Loss. This transfer to Profit and Loss is generally the sole entry on the credit side.

Goods.—This account will comprise things bought for the purpose of the business and not falling under any of the heads already mentioned, and also the value of work done for the firm by others; such, for instance, as woodcuts, electros, and stereos, the cost of machining formes, of binding, and so forth. These and other purchases will be entered on the debit side. To the credit side will be posted the amount of the work done by the firm and charged to customers as per the Day Book. At the end of the year (or half-year) stock is taken of the goods on hand and the value entered on the credit side of the account, the same amount being brought down to the debit of the next account as in the "Consumable Material Account." The balance of the account is transferred to Profit and Loss.

All these accounts, which, as we have said, are called "Impersonal accounts," may be entered in the general Ledger of the concern; but if the business be of any magnitude, it will be found best to have a separate ledger for them, and to enter in the general Ledger the personal accounts only, *i.e.*, the accounts of persons or firms by or to whom money is payable.

The Cash Book.—The nature of this book is also well known to almost every one. It generally has one money column and a date column on each page, with a blank space between for particulars of the entries. The receipts are entered on the left-hand pages, and the payments on the right-hand pages. When items are "posted" in the Ledger, the receipts are entered on the right-hand or credit sides of the accounts in that book, and the payments on the left-hand or debit sides.

Instead of having only one money column on each page, it is better to have three, as shown on page 451.

The first of the three money columns on the left-hand page (which we will call Column No. 1) is for discounts allowed *by* the firm. Thus "John Smith" is supposed to have paid £4 8s. 0d., and to have been allowed a discount of 4s. 6d. Both these sums are posted to the credit of John Smith's account on folio 18 of the Ledger.

In the second column (Col. No. 2) are to be entered sums of money received and not paid into the bank.

The third column (Col. No. 3) is reserved for sums received and paid by the firm into its account with its bankers.

The first money column on the right-hand page (we will call it Col. No. 4) is for discounts allowed *to* the firm. Thus, the firm is supposed to have paid H. Brown £15 in settlement of his account of £16 10s. 0d.; the discount, £1 10s. 0d., is entered in Col. No. 4, and both sums are posted to the debit of Brown's account on folio 1 of the Ledger.

The second column on the right-hand side (Col. No. 5) is for payments made out of the office till.

The third column on the same side (Col. No. 6) is for payments made by cheque, or otherwise, through the firm's bankers.

It is obvious that if we subtract the total of Col. 6 from the total of Col. 3, we find the amount of cash at the bank; while if we subtract the total of Col. 5 from the total of Col. 2, we find the sum there ought to be in the till.

The Bought Journal.—This is a very useful and, in large offices, a necessary book. In it are entered all purchases made by the firm. Such a book, if ruled specially, will save a great many entries in the Ledger. It will be found convenient to have it arranged so that the "faint" lines run without break from edge to edge across the fold, and to have columns ruled for: 1. Date. 2. Name of Vendor. 3. Ledger Folio. 4. Amount of Invoice. 5. Value of Machinery or Standing Plant included in the Invoice. 6. Value of Type included in the Invoice. 7. Value of Brass Rule, Leads, etc., in ditto. 8. Value of Consumable Material in ditto. 9. Various. That is to say, to have the usual date, name, and folio columns, and six money columns.[1]

Suppose the printer to have given an "outfit" order to one of the general printers' furnishers, whom we will call "Smith & Co." The invoice, reaching a total of (say) £600, may contain items amounting to £400 for Machinery and Plant, £150 for Type, £20 for Brass Rule, Leads, Furniture, etc., and £30 for Ink and other consumable stores. The printer or his clerk will enter in the Bought Journal the date of the invoice (say July 10, 1900), and the name "Smith & Co.," and in Col. No. 4 (the first of the money columns) he will enter £600; in the column for "Machinery," he

[1] See specimen on page 454.

Dr. CASH.

			L. f.	Discount £	s.	d.	Office £	s.	d.	Bank £	s.	d.
1900				£	s.	d.	£	s.	d.	£	s.	d.
Jan.	1	Balance . .	...	...	...	...	5	3	6	221	4	10
	2	Smith, John . .	18	0	4	6	...	...	...	4	8	0
	,,	Jones, H. . .	50	...	...	...	0	16	6	...	...	...
	3	Office Cheque .	X	...	...	...	15	0	0	...	...	...
	15	Bill Receivable, No. 5	501	...	...	...	...	...	...	30	0	0
		Robinson, H. .	27	5	4	3	...	...	...	...	...	...
				5	8	9	21	0	0	255	12	10

CASH. *Cr.*

			L. f.	Discount £	s.	d.	Office £	s.	d.	Bank £	s.	d.
1900				£	s.	d.	£	s.	d.	£	s.	d.
Jan.	3	Brown, H. . .	1	1	10	0	...	...	...	15	0	0
	,,	Jones & Co. . .	4	...	...	...	0	18	0	...	...	...
	,,	Office Cheque .	X	...	...	...	...	...	...	15	0	0
		Acceptance, No. 7	507	...	...	...	...	...	...	20	0	0
	,,	Wages . . .	600	...	...	...	14	10	0	...	...	...
				1	10	0	15	8	0	50	0	0
		Balance .	...	...	...	...	5	12	0	205	12	10
				1	10	0	21	0	0	255	12	10

The specimen entries given explain themselves, except perhaps these:—

"Balance, £5 3s. 6d.—£221 4s. 10d." The £5 3s. 6d. shows the balance in the till, the £221 4s. 10d. shows the balance at the bank: the two together, *viz.*, £226 8s. 4d., represent the total cash balance on the 1st of January, 1900.

"Office Cheque, £15 0s. 0d."—This occurs on both sides of the account, and is thus explained. The till has required replenishing, and so a cheque has been drawn for £15 and cashed. We have, therefore, to enter £15 in Col. No. 6, as paid out of the bank, and the same amount in Col. No. 2, as money received into the till.

"Robinson, H., £5 4s. 3d."—This £5 4s. 3d. is discount allowed to Robinson by the firm. The reason there is no entry in either of the Cash columns is because Robinson did not pay cash, but gave the firm his acceptance for the amount of his account, minus the £5 4s. 3d.

The figures "18, 50, 1, 4," etc., represent the folios of the Ledger to which the items are posted. There is no need to post the £15 office cheque anywhere, and so we simply put an **X** in the folio column on each side.

will enter £400 ; in the column headed "Type," £150 ; and so on, until the whole of the £600 is disposed of.

When he buys his paper, say of "Jones & Co.," he will enter upon the next line of his Bought Journal the date of their invoice and their name, and in Col. No. 4 the total of their invoice—say £60—and the same amount in the column headed "Material."

Day by day he will "post up" this Bought Journal; that is, he will make the appropriate entries in the Ledger. Opening an account (say on folio 5) to "Smith & Co.," in it he will, on the right-hand or credit side, write the words : "1900, July 10. By Goods, B. J. 1, £600 0s. 0d.," and immediately afterwards will, in Col. No. 3 of the Bought Journal, enter the figure "5," that being the folio of the Ledger on which "Smith & Co.'s" account is to be found. Then he will (say on folio 10 of the Ledger) open an account to "Jones & Co.," and will pursue precisely the same plan with regard to the item of £60 for paper. But he will as yet take no notice of columns Nos. 4 and 9 of the Bought Journal; he will wait until the end of the half-year, and then he will add up each of such columns and post the total of each to the debit side of its appropriate Impersonal account of the Ledger. Thus, assuming, for the sake of illustration, that he buys nothing more during the half-year, he will, in the Ledger account headed "Type," enter : "To Smith & Co., B. J. 1, £150," and in the Consumable Material account he will enter: "To Smith & Co., B. J., 1, £150," and so on. Should he, however, have made several purchases of type and ink of various firms, he will not name these, but will enter in the Type account the total amount of the Type column of the Bought Journal, prefixing the words: "To sundry firms," and will do the like with the Consumable Material account, and all others of the same kind.

The invoices of goods entered in the Bought Journal

should be pasted into a guard book in the order of their dates, and thus preserved for reference.

The Orders Received Book.—This must be ruled with faint lines, and should be so carefully bound up that these run across the fold without break, for, unless the page be a very wide one, it will be necessary to continue each entry right across the opening. It should be ruled for columns headed: 1. "Job No." 2. "Date." 3. "Name of Customer." 4. "Address." 5. "Description of Job." 6. "When Wanted." 7. "When Delivered." 8. "Charge." 9. "Remarks."[1]

The object of this book is explained by the headings of the various columns. It is a record of all the work ordered of the printer. The consecutive numbering of each job is most useful, as it serves to identify it in dockets and other papers where it is referred to. We give a specimen of an entry in this book:—

"253. July 25. J. Brown, 18 High Street, Lincoln. 500 Business Cards, 2 colours. July 27. Parian cards, supplied by customer."

[1] See specimen on next page.

BOUGHT JOURNAL.

Date.	Name.	Ldgr. Fol.	Amount of Invoice.			Machinery, etc.			Type.			Rule, Leads, etc.			Consumable Material.			Various.		
1900.			£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
July 10	Smith & Co.	5	600	0	0	400	0	0	150	0	0	20	0	0	30	0	0	...	...	...
,, 12	Jones & Co.	10	60	0	0	...	...	...	...	...	...	...	...	...	60	0	0	...	...	...
,, ,,	Robinson (for Job 23)	15	1	7	6	...	...	...	...	...	...	...	...	...	...	...	...	1	7	6

ORDERS RECEIVED BOOK.

No. of Job.	Date.	Name of Customer.	Address.	Description of Job.	When Wanted.	When Delivered.	Charge.			Remarks.
	1900.						£	s.	d.	
253	July 25	J. Brown . .	18 High Street, Lincoln	500 Business Cards, 2 colours	July 27	July 27				
254										

The whole of this entry will be written in by the clerk in the counting house when the order is received, except of course the date of delivery and the charge, which will be filled in when the goods are sent home. He will, in red ink or blue pencil, endorse conspicuously on the "copy" the number "253," and then send it to the jobbing room, with the proper instructions written upon a ticket of the following form:—

INSTRUCTION TICKET.

N.B.—This Ticket must accompany the Job throughout.

Job No. ______ *Date* ______ 19

Customer ______

Description of Job ______

______

Quantity ______

Kind of Paper or Card to be used ______

Special Instructions ______

______

______

Proof wanted ______ *Job wanted* ______

Job set by ______	*Worked by* ______
Proof out ______	*On* ______ *Machine No.* ______
Proof returned ______	*Worked off* ______ 19
Out of Composing Room ______	

Delivered ______ 19 *Charge £* ______ { *Cost Book Folio* / *Day Book Folio* ______ }

The compositor on receiving it will look at the clock, and then proceed to set up the job. He will take note of all the time he is engaged on it, and when it is out of his hands he will fill up one of his dockets and annex it to the Instruction Ticket, to which he will attach also a proof of the job.

Dockets.—The Compositor's Docket should be in the following form:—

COMPOSING-ROOM JOB DOCKET.

*Name of Compositor*____________________

*Job No.*__________ *Date*____________19

Nature of Job ____________________

	Hours.	Minutes.	£ *s. d.*
Setting on 'stab . . .			
,, ,, *overtime* .			
,, *on piece* . . *ens*			
Proofing			
Correcting			
Total . . .			

Remarks:

It is only the piece hands who will fill in the money value of the work: this they will of course do at the scale price, the figures representing the wages they have earned on the job. The money value of the time spent on it by the 'stab hands will be calculated in the counting house.

The Machine-room Docket will be as follows:—

MACHINE-ROOM JOB DOCKET.

Name of Machine Minder ______________________

Job No. __________ *Date* __________ 19

Nature of Job ______________

Machine used ______________ *No.* _____

Paper used ______________ *r.* _____ *q.* _____ *s.*

Ink used ______________

	Hours.	Minutes.
Making ready		
Proofs		
Working		
„ *overtime*		
Total		

Remarks:

Order Received ______ 19__ *Job No.*__ *Job Delivered* ______ 19__

Nature of Job ______

Quantity ______

Kind of Paper or Card to be used ______

Name of Customer ______

Proof wanted by ______

Special Instructions:

	H.	M.	£	s.	d.
COMPOSING.					
Compositor engaged on Job					
....					
Proofing					
Correcting					
Author's Corrections . .					
Remarks:					
READING.					
Reader.............................					
Remarks:					

	H.	M.	£	s.	d.
Brought Forward .					
MACHINING.					
Minder...........................					
Machine used *No*.......					
Making Ready . . .					
Proofs					
Working					
Paper used *r*......*q*......*s*......					
Ink used					
Bronze used					

STEREOTYPING OR ELECTROTYPING.				
No. of Plates				
Paid out :				
Engraving				
Process Blocks . . .				
Special Type, Rule, etc. . .				

WAREHOUSE.				
Paper, Nature and Price .				
Cards				
Quantity given out . .				
Cutting				
Folding.				
Sewing				
Wire Stitching . . .				
Perforating				
Ruling				
Paging				
Eycletting				
Despatching				

Invoiced out ____________________ 19

at £ *s.* *d.*

Cost Book Folio ____________________

Day Book Folio ____________________

There should also be dockets for the Paper Warehouseman, showing the quantity, nature, and price of the paper or cards given out for each job, and time dockets for every other department, each workman entering up his own work and attaching his docket to the Instruction Ticket as soon as the job is out of his hands. It is a good plan for these to be written with a pencil over carbon paper in a book of flimsies, so that each man keeps a duplicate of his docket.

The job being finished, the Instruction Ticket, with all the dockets attached, comes back to the counting house. From them the pricing clerk will be able to make up the Cost Book, showing the cost of each job, and the Day Book, showing the charge made to the customer.

In many offices the Instruction Ticket and all the dockets are combined on one piece of paper, as shown on pp. 458-9. In others a Manilla envelope of adequate size is used for every job, the Instruction Ticket being printed on one side and the dockets on the other. When the job is finished the copy, proofs, a perfect print, etc., are put inside and the whole filed.

In small offices, where each operation is under the personal supervision of the proprietor of the concern, some, or perhaps all, of the work dockets may be dispensed with, the entries being made by him from memory straight into the Cost Book, which book may be made to embrace the Order Book and the Day Book too, thus considerably reducing the amount of bookkeeping. But in large concerns a good system of dockets is absolutely necessary, and it will always be found desirable to have separate Order and Day Books.

The Cost Book.—We have now to see that everything is charged to the customer, and a succinct record kept of the cost of each job executed in the establishment. In order that this may be done readily, and that no item of expense may be lost sight of, it is desirable to keep a *Cost Book*, printed and ruled according to the annexed plan :—

SPECIMEN PAGE OF COST BOOK.

Name of Customer ____________________

Job No. ________ *Job Ordered* ____________________ 19______

,, *Invoiced* ____________________ 19______

Nature *Orders Received Book Folio* ______

	TIME.		COST.		
	H.	M.	£	s.	d.
Paper or Cards					
,, *(Cover)*					
Composition (day)					
,, *(night)*					
Distribution					
Reading					
Corrections					
Author's Corrections . . .					
Proof Pulling					
Imposing					
Reimposing					
Preparing Stereo					
Stereos or Electros					
Metal					
Machining (*Machine, No.*) .					
,, ,, .					
,, ,, .					
Ink (black)					
,, *(coloured)*					
Bronze					
Dusting					
Folding					
Ruling					
Paging					
Perforating					
Binding					
Cutting and Parcelling . . .					
Paid out :					

Total Cost . . . . £			
Add			
Amount Charged . . . . £			

Day Book Folio ________

The Cost Book is of course kept in the counting house, and is made use of only when a job is completed and has to be entered up. The clerk will have before him a print of the job itself, and the various dockets relating to it mentioned above. From these papers he will easily be able to fill in the proper prices against the various items. The compositors' dockets will show that they spent so many hours on the job, and the clerk will know how much an hour each compositor earns. So with the machining: here he will have to calculate the cost, not only of the workman's labour and skill, but also of the ink and the value of the employment of the machine used. The paper warehouseman's docket will provide him with information as to the quantity and quality of the paper used, and, furnished with this, he will readily calculate the cost of it. Thus each item will be ascertained, and, by the simple process of addition, the total cost will be rapidly arrived at. Then has to be considered what should be added to provide for the proper proportion of motive power and counting-house expenses, coals, gas, rent, rates and taxes, wear and tear of type, machinery, etc., and a fair profit for the master printer. Thirty-three per cent., or one-third of the total cost, is scarcely ever too much to add for this purpose, and many classes of work should be charged even more heavily. This being added, the final total gives the sum chargeable to the customer. This might be posted direct from the Cost Book to his account in the Ledger; but for various reasons, one of which we will mention directly, it is desirable to enter it first in a *Day Book*.

Some firms prefer to have in the Cost Book an extra (outer) column, in which they can enter the charge for each item as against the cost. The total of this makes the amount charged to the customer, and entered in the Day Book.

The Day Book.—This is an ordinary tradesman's book,

such as is to be found in every retail and wholesale establishment, as well as in every merchant's office. It should be ruled with two money columns and a "folio column," besides a column for dates. At the top of each page should be written the name of the month and the year, and beneath are to be entered the names of the customers, and the nature and value of the work done for them, just as the same is invoiced. We append a sample page of the Day Book, with specimen entries:—

SPECIMEN PAGE OF DAY BOOK.

AUGUST, 1900.

			£	s.	d.	£	s.	d.
	Brought forward .					51	7	4
4	*E. Smith & Co.,* 240 *Oxford Street* .	*18*						
	2,000 *Memorandum Heads, c. ld., 8vo* .	30	0	15	6			
	10,000 *Trade Cards* .	31	3	17	0			
						4	12	6
6	*H. Jones,* 114 *North Road* .	*50*						
	10,000 *Handbills, "Best Congou"* .	32				0	16	6
	Forward					56	16	4

The figures 4 and 6 in the first column refer to the days of the month of August on which the goods were sent out; the other entries explain themselves, except the figures in

the "folio column." Of these the "18" and the "50" refer to the pages of the Ledger on which the accounts of Messrs. E. Smith & Co. and Mr. H. Jones are respectively to be found, and to the debit (or left-hand) side of which the items are posted. The "30, 31, and 32" refer to the pages of the Cost Book from which these entries have been taken. Each page of the Day Book is added up and the amount carried forward until the end of the month, when the total for the month is posted to the *credit* side of the account in the Ledger, headed "Goods."

With the exception of a Bill Book, in which to enter particulars of all Bills of Exchange given and taken by the firm, the above are all the books necessary for a printer to keep in his counting house—and quite enough too, we are ready to concede. It will be observed that we take no notice of the "Journal" so often referred to by Messrs. Hamilton & Ball and the other writers on bookkeeping. We do so advisedly; because, although useful in a perfect system of bookkeeping, it is a book which in most printing offices may be dispensed with, and we will not urge the printer to keep any more accounts than are really necessary to enable him to determine his business position with accuracy.

The Balance Sheet.—We have now to suppose that the printer has reached the end of his first working half-year, and is desirous of knowing what profit he has made and how the respective accounts of his liabilities and assets stand. We must assume that he has throughout the period kept a full and faithful record of all matters concerning his business in the books previously indicated: that he has kept separate Ledger accounts of—1. Buildings. 2. Rent, Rates, and Taxes. 3. Machinery and Standing Plant. 4. Type. 5. Brass Rule, Leads, and Furniture. 6. Consumable Material. 7. Wages. 8. Goods. 9. Casual

Expenses. The items under the heads numbered 3 to 6 will be in the Bought Journal, the prime entries of the Casual Expenses will be partly in the Bought Journal and partly in the Cash Book, and those for the work done and charged for will be found in the Day Book. The Dockets and Cost Book will not be required for the present purpose.

The first thing to be done is to ascertain how much consumable material is on hand. To do this, the master printer should "take stock," that is, ascertain by actual inspection how much of each kind he has left. If he has kept stock books as hereafter mentioned, the balances of these will show him how much of each article he has on hand. Take the "Ink Book": if he has entered in the "Shilling Black" account every pound he has bought and every pound he has given out to his machine minders, it is obvious that the balance will represent the quantity in stock; and so with the other kinds of ink, the coals, the paper, the roller composition, and so on. But even if such accounts have been kept, it is desirable to check them by taking stock, and to ascertain, by counting, measuring, or weighing, that the quantities shown by the accounts to be in stock actually are there.

Having then made a list of all consumable material on hand, the various items must be priced out, and the value of the whole ascertained by addition.

Now let us open in the Ledger, or, if it is preferred, in a Private Ledger, an account headed "*Profit and Loss.*" Having done this, let us turn to the Buildings account in the Ledger. Here, on the debit side, will be found all sums spent or debts incurred in respect of repairs to premises during the half-year. (We shall assume our printer rents his premises, and does not own them.) We add up these sums, insert the total, say £15, and on the

credit side of the same account write "*By Profit and Loss*, £15 0s. 0d.," and then rule up the account. (See *Buildings account, Specimen B*," shown on page 443.) Now we turn to the Profit and Loss account, and on the debit side enter "*To Buildings*, £15 0s. 0d." The next account to be dealt with is that of Rent, Rates, Taxes, etc. Here, on the debit side, will be found all outgoings on these heads, and on the credit side all incomings from the letting-off of part of the premises to sub-tenants (if any): the balance of the account will be the net expense, and the amount of it, say £74 5s. 10d., must be dealt with in precisely the same way as the balance of the Buildings account.

Now we come to the Machinery and Standing Plant account. Here we have to do something different. On the debit side stands the total cost of machinery and plant of the office posted from the special column in the Bought Journal, say £650. This represents part of the printer's capital, but it is continually decreasing in value, owing to wear and tear. On the right-hand side of the account we must therefore write off a sum for depreciation during the half-year, say 3½ per cent. on the cost. This will be £22 15s. 0d. Our entries will be as follows: In the Machinery account we shall insert on the credit side, "*By Profit and Loss, 3½ per cent. for depreciation*, £22 15s. 0d.; *Balance carried down*, £627 5s. 0d.; *Total*, £650;" and after ruling up, we shall write on the debit side, "*To balance brought down*, £627 5s. 0d." Turning to the Profit and Loss account we shall enter on the debit side, "*To depreciation of Machinery and Plant*, £22 15s. 0d." The accounts headed "Type" and "Brass Rule, etc.," will be treated in precisely the same way, only the percentage to be written off will be larger (as already stated), and each time the amount written off must

be entered on the debit side of the Profit and Loss account. Let us assume that the amount written off type is £7 2s. 0d., that the amount written off brass rule, leads, furniture, etc., is £5, and that the balances of these accounts brought down (on the debit side) are respectively £111 10s. 6d. and £20.

The account of Consumable Material will again be differently dealt with. Here, on the debit side, we find the total cost of all coals, paper, ink, composition, turps, and other consumable stuff bought during the half-year, and posted from the "Materials" column in the Bought Journal: say £533 0s. 0d. We next look at our stock sheet and find the values of all such things now on hand. These we shall enter on the credit side of the Ledger account, and add them up. (*See the specimen, Consumable Material Account.*) The balance of the account will manifestly represent the value of what has been consumed during the period. This, amounting to, say, £261 0s. 0d., we will transfer to the Profit and Loss account by crediting Consumable Material, and debiting Profit and Loss with it. The Consumable Material account will then be ruled up, and the amount of stock carried down on the debit side, thus: "*To Stock brought down*, £272 0s. 0d."

The next accounts are those headed "Wages" and "Casual Expenses." There will seldom or never be anything on the credit side of these accounts, so the whole amounts—say £800 in one case, and £35 in the other—will be transferred to Profit and Loss in the same way as has been done before.

Now we come to the Goods account. In this have been entered, on the credit side, the total of the Day Book, *i.e.*, the amount of the work done by our printer and charged to his customers—say £1,500—and on the other side the value of work done for him by other tradesmen, such as the cost

of engravings, of electros and stereos, of machining formes, of binding, etc., etc., say £45. The printer must now consider whether any portions of the things included in this account are available as his assets, and, if so, what they are worth. For instance, if, for his own benefit, he has had electros taken of certain pages because he has a running contract to print so many copies a quarter, he may fairly look upon them as so much good property; but if he has had woodcuts engraved for his customers and has charged them with the cost, these are not his assets at all. We shall assume that he makes out a list of all such as are his own property, and that he values them at what they really are worth to him, say £15. This sum represents stock, and must be dealt with precisely as the stock of the consumable material was. The balance of the Goods account will be carried to the credit side of Profit and Loss, the account will be ruled up, and the £15 brought down as a balance on the debit side.

The Goods account will then stand thus:—

GOODS.

Dr.				*Cr.*			
To Sundries as per Bt. Jnl.	£45	0	0	*By Work done as per Day Book* . . .	£1,500	0	0
„ *Balance to Profit and Loss*	1,470	0	0	„ *Stock carried down* .	15	0	0
	£1,515	0	0		£1,515	0	0
To Stock brought down . .	£15	0	0				

We have now all the requisite items in our Profit and Loss account, and have only to balance the account to see what profit has been made during the half-year. The account will stand thus:—

PROFIT AND LOSS.

CREDIT SIDE :—			
By Goods	£1,470	0	0
DEBIT SIDE :—			
To Buildings	£15	0	0
„ *Rent, Rates, Gas, etc.*	74	5	10
„ *Depreciation of Machinery and Plant* . .	22	15	0
„ *Ditto of Type*	7	2	0
„ *Ditto of Brass Rule, Leads, etc.* (say) . .	5	0	0
„ *Consumable Material used*	261	0	0
„ *Wages* (say)	800	0	0
„ *Casual Expenses* (say)	35	0	0
	£1,220	2	10
Balance Profit	249	17	2
	£1,470	0	0

If there be but one person in the firm, this balance will not be brought down, but will be transferred to the account in the Ledger headed with his name, and entered there on the credit side. On this side also will have been already entered the amount of capital he brought into the business, and on the contrary side the sums he has, from time to time, drawn out. The balance of the account will show what his interest in the concern is at the end of the half-year in question.

If, however, there are two or more partners, the balance of the Profit and Loss account will be brought down (on the credit side), and on the debit side it will be apportioned to the partners in their proper shares, *e.g.* :—

To William Caxton, 2/3rds	£166	11	5
To W. de Worde, 1/3rd	83	5	9
	£249	17	2

And these sums respectively will be entered to the credit of the partners' separate accounts. The Profit and Loss account will then be ruled up again.

As regards the making-up of a Balance Sheet, we must refer the reader to the work before mentioned, or, indeed, to any book on account keeping. The following items will appear in the account :—

LIABILITIES :—

Sundry Creditors as per list	£		
(The total of all the firm's debts shown in the Ledger)			
Ditto on Bills Payable			
(The amount of all acceptances not yet paid)			
	£ (*a*)		
William Caxton			
(The balance of his a/c)			
W. de Worde			
(The balance of his a/c)			
	£ $x + y + z$		

(*a*) The amount entered here will be the sum total of the Creditors and Bills Payable.

ASSETS :—

Amounts due to the firm by sundry Debtors as per list	£		
Ditto on Bills Receivable			
Cash Balance			
	£ (*b*)		
Machinery and Plant	627	5	0
(The balance of the a/c so headed)			
Type (ditto)	111	10	6
Brass Rule, Leads, etc. (ditto)	20	0	0
Stock of Consumable Material, as per account .	272	0	0
Stock of "Goods," as per account	15	0	0
	£ $x + y + z$		

(*b*) This amount will be the sum total of the three previous lines, and will represent the total assets available for the payment of the firm's trade liabilities, or, in other words, for payment of the sum entered at (*a*).

It is to be remembered that if the books have been properly kept, the total of the debits will always be the same as the total of the credits, and therefore the Balance Sheet ought invariably to balance to a penny. This is explained at length by Hamilton & Ball.

We have now specified the counting-house bookkeeping necessary in a printer's business, but there are still some subjects to be dealt with.

Time Records.—In the first place it is necessary, for various purposes, to have a record of the time kept by each man, and the way he uses it. Therefore the timekeeper must have a book in which to enter the name of each workman, and the number of minutes he loses each day.

TIMEKEEPER'S BOOK.

Time Lost.

NAME.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	TOTAL.

This book, at (say) 11 A.M., he sends in to the overseer, who, after using it as after-mentioned, returns it.

Where practicable the timekeeper keeps another book recording the overtime worked by each hand; it is the same in form as the book for time lost.

OVERSEER'S TIME BOOK.

Week ending..

NAME.	Overtime.						TOTAL.	Time Lost.						TOTAL.	Balance.	
	M.	T.	W.	Th.	F.	S.		M.	T.	W.	Th.	F.	S.		To good.	To bad.

Often, however, he cannot do this, and then the duty falls on the overseer. The overseer keeps a book ruled and headed, as on the previous page. If both lost time and overtime are recorded by the timekeeper, the overseer has simply to transcribe both from the timekeeper's book, and strike the balance at the end of the week, otherwise he has to take note himself of the men's time, and make his entries from such note.

These records are necessary, not merely to show the habits of the men, but to ascertain the amount due to them each week.

The next thing to be ascertained is how each man employs his time. For this purpose it is desirable that each workman in the establishment should render to the counting house daily, besides the Job Dockets mentioned previously, a *Time Sheet*, showing on what jobs he has been engaged, and what time he has spent on each. These will constitute a valuable check upon the men in large offices, where they cannot be under the constant supervision of their employer. Here are forms of some :—

TIME SHEET.

Date ____________________

Name of Workman ____________________

Room ____________________

Job No.	Nature of Job.	Work Done.	Ordinary Time.		Overtime.	
			Hrs.	Mins.	Hrs.	Mins.
		Total...............				

MACHINE MINDER'S TIME SHEET.

______ *Machine No.* ______

Date ______ 19 . *Minder* ______

	ON AT.	OFF AT.
Job No. *Nature of Job :* *Sig. of Forme :* *Total No. to be worked :* *No. worked To-day :*		
Job No. *Nature of Job :* *Sig. of Forme :* *Total No. to be worked :* *No. worked To-day :*		
Job No. *Nature of Job :* *Sig. of Forme :* *Total No. to be worked :* *No. worked To-day :*		

	REAMS.	QRS.	SHTS.
Reams done at 1 o'clock			
Done from 2 till 7 or 7·30.			
HOURS WORKED.			
Done Overtime			
Total...			

Accident or Stoppage, and cause of ditto

Overseer's Signature ______

Piece hands usually make out their dockets weekly, and as they are paid by results only, there is seldom any necessity for a more frequent record. A very useful Work Account for piece hands in the composing room has been devised by the overseer of one of the large London offices. It is as follows :—

PIECE DOCKET.

Name of Work ____________________

Name of Compositor ____________________

Week Ending ____________________

Job No.	Name of Article.	First Word.	Last Word.	Thousands of				
				Long Primer.	Bourg.	Brevier.	Minion.	Nonp.
			Total......					

Work Records.—The overseer should keep a permanent record of all work done, and for this purpose should have two books, called the "Overseer's Book for Job Work" and the "Overseer's Book for Bookwork." Specimens of these are shown on the next page.

OVERSEER'S BOOK FOR JOB WORK.

No. of Job.	Date.	Name and Description of Job.	By whom done.	Time.	Over-time.	Proofs.	Stereo-typing.	Various.

OVERSEER'S BOOK FOR BOOKWORK.

Name of Work and Customer..*Job No*..............

Date.	Name of Workman.	'Stab or Piece.	Hours engaged.													Money value.		
			Compos-ing.		Distri-buting.		Correct-ing.		Proof-pulling.		Press or Machine work.		Stereo-typing.	Ware-house.				
				O.T.		O.T.		O.T.		O.T.		O.T.			O.T.	£	s.	d.

MACHINE-ROOM RECORD.

For Week ending..19......

Name of Machine.	No. of Machine.	Nos. of Jobs Worked.	Impressions this Week.	No. of Hours Working.	No. of Hours Idle.	Ink Used.	Value of Ink Used.		£ s. d.
								Machine Room Wages Roll .	
								Ink used . .	
								Sundry Expenses . .	
								Total for the Week . .	£

The Job Book is easily made up from the job dockets, which will pass through the overseer's hands before they go to the counting house. Indeed, in some offices, they remain with him, and the Cost Book is made up from his job book.

Bookwork requires to be differently dealt with. A job of this kind may extend over weeks ; what it costs in labour can only be ascertained by recording all the time spent on it, and the money value thereof. The overseer, therefore, must keep a separate page or pages (as in a ledger) for such work, and every day must enter thereon, from the daily time sheets of the men, the labour spent on it, and the money value thereof. By so doing, when the work is completed, the firm will know either what to charge or whether the estimate they gave for it pays or not.

It is useful also for the overseer to keep another book, which may be called the "Men's Work Record." In this a separate page or number of pages should be taken for each day, and therein should be entered the name of every man and boy employed, a statement of what he has been doing, when he began, and when he finished the particular work.

The "Machine Room Record," of which a specimen page is given, if regularly kept enables the master printer to calculate whether he is getting what he ought out of his various machines, and what the expense of his machine department is.

Paper Records.—Paper is a commodity of which, in an office of any pretensions, it is necessary to keep accurate accounts, especially as it often happens that a work is printed on paper sent in by the customer.

There should be a book, called the "Paper Ledger," ruled ledger-wise, in which should be kept debtor and creditor accounts of every kind of paper and cards brought into the office, a separate opening being devoted to each

kind, and if there be in the office paper of the same kind, but belonging to different owners, each owner's must be treated as entirely distinct.

Here is a specimen account :—

PAPER LEDGER.

WHITE DOUBLE DEMY 23 LB. (Grosvenor, Chater & Co.).

RECEIVED.	Rms.	Qrs.	Shts.	USED.	Rms.	Qrs.	Shts.
1900.							
July 3	50	0	0	July 6—For Sig. B of Job 27 . .	18	0	0
„ 12	20	0	0	„ 8—For Job 31 . .	3	7	0
				„ 16—Sigs. C & D of Job 27 . .	36	0	0

If the paper belonged to a customer, the account would be kept in the same way, only the name of the owner would be prefixed ; thus, "Mr. J. Brown's White Double Demy."

Cards are to be treated in the same way, only the account is in "packs and cards" instead of reams, quires, and sheets.

Obviously an entirely separate account must be kept for each size and weight of paper. It will not do to mix up 30 lb. Double Demy with 36 lb. paper of the same size, or 28 lb. Double Crown with 28 lb. Double Large Post.

The book must be properly indexed like a ledger.

At intervals an account must be rendered to each customer who supplies his own paper. This will be a transcript from the Paper Ledger balanced up, thus :—

PAPER ACCOUNT.

WHITE DOUBLE LARGE POST 32 LB. (Spicer Bros.).

RECEIVED.	Rms.	Qrs.	Shts.	USED.	Rms.	Qrs.	Shts
In stock, as per last Statement	15	0	0	For 2,750 Copies "B.G." 62 pp. . . .	21	6	17
Aug. 26, from Spicer Bros. .	35	11	0	„ 2,500, 10 pp. . . .	3	2	16
				Balance in hand . .	26	1	15
	50	11	0		50	11	0

In large houses, besides the Paper Ledger, there is kept a book, corresponding to a day book, in which is recorded consecutively, in order of date, each lot of paper received. This is called a

PAPER RECEIVED BOOK.

Date.	Quantity.			Size and Quality.	Mill No. Weight.	Cost per Ream.	From Whom Received.	Folio of Paper Ledger.	For what Job or for Stock.
	Rm	Qrs.	Sht						

When paper is wanted in the press or machine room, the overseer sends the warehouseman a written requisition for it, which he files, and on delivering the paper he records the fact in the

PAPER GIVEN OUT BOOK.

Date.	No. of Requisition.	Quality, etc., of Paper.	Size and Price.	Quantity Good Paper.			Waste Sheets Supplied.			For what Work.	Fo. in Paper Ledger.
				Rms.	Qrs.	Shts.	Rms.	Qrs.	Shts.		

Where these two books are kept, the Paper Ledger is posted up from them from time to time.

These are, unfortunately, by no means the only records that have to be kept of paper in a large establishment. It is often necessary to keep account of the sheets in their different stages. Various systems of bookkeeping are adopted. A concise book may be divided thus :—

Work ______________________________

Description of Paper ______________________________

Received from Stationers.				Delivered to Press Room.				Received from Press Room.				Delivered to Publisher.			
Date	Rm.	Qrs.	Sht.	Date	Rm.	Qrs.	Sht.	Date	Rm.	Qrs.	Sht.	Date	Rm.	Qrs.	Sht.

The whole of the columns of quantities are made to balance in this manner: To the quantity received from the stationers will ultimately require to be added the amount of spoilage in its passing through the press room. So many "overs," or overplus sheets, according to the rule of the house and the character of the work, must be delivered to the press room. A certain quantity of these will not come back. More spoilage will occur in the warehouse room, and the quantity of perfect sheets, as recorded in the last column, *plus* the spoilage, *plus* the overs, will be equal to that in the first column, and the whole account will, as we have said, balance.

Still another book must be kept when the sheets of a work are delivered piecemeal to the publisher, so as to show what sheets are in stock. This is called the

WAREHOUSE STOCK BOOK.

Name of Work and Customer..

Signature of Work.	Date.	Copies Recd. from Press.	Date.	Copies Dlvd.	To Whom.

This will have to be properly indexed like a ledger.

Type Records.—Whatever the size of the office, a Type Record is desirable. It is an ordinary quarto or octavo book, ruled like a day book, but in addition to pounds sterling, pounds weight have to be recorded. Each fount, as it comes in, is entered at the top of a separate page, and below are entered the date, weight, and cost. When sorts are procured, or the fount is otherwise enlarged, additional entries are made on the page. The printer can thus tell at a glance what founts he has in his place, what their strength is, what they cost, and, in fact, their whole history. When any are sold or put into the metal pot, that fact is recorded on the pages in red ink. Here is a specimen page :—

SMALL PICA, NO. 19, ROMAN & ITALIC (*Miller & Richard*).

1900.		lb.	oz.	£	s.	d.
July 8	From M. & R.	232	3	13	10	1
,, 27	,, ,, ...	15	8	0	18	1

When jobbing founts are recorded, it is well to paste a specimen line at the head of the entry, as well as to record the title of the fount. In every case the founder's name should be mentioned, and if the fount is specially nicked the nicks should be noticed.

Ornaments, wood letter, and the like should be treated in the same way.

Ink Records and other stock books may be kept, too, if desired ; only their use is not so apparent as in the case of type. Here a debtor and creditor account is necessary for each kind of ink, etc. On the left hand the storekeeper enters all that comes in, and whence, and on the right hand all he gives out, and to whom. The balance of the account shows the quantity of the particular kind that is in stock.

Block Records.—The keeping of woodcuts and electros is a source of no little trouble to a printer. Many of them do not belong to him, but are sent in by customers, who often, months after they have been used, direct them to be given up at once to some third party. Long after this, and

forgetful of the fact, they send again and ask for them to be given up to themselves, and unless the printer has a record of his dealings with them, much time and temper are likely to be lost in a fruitless search.

The best way of recording blocks is to have a folioed guard book with an index to it. Whenever a block comes in, let a pull of it be taken and stuck into the guard book; under it should be written these facts: (1) number of block; (2) short description of block; (3) if original woodcut or electro; (4) name of owner; (5) from whom received; (6) whenever the block is placed in the block cabinet or store closet, the number of the press and shelf should be entered in the book, and a number corresponding with the folio of that book stuck on the block itself. The book is indexed according to the name of the customer whose the blocks are. Therefore, when a block is sent for, the pull of it in the block book can be readily turned up, and the position of the electro in the closet ascertained. On its being given up, a receipt should be taken for it, in a book to be kept for the purpose, and the date of delivery, and name of the firm to whom it is given up, entered in the block book under the former entries concerning it. Thus a complete record is kept of every cut entrusted to the printer, and its history is apparent upon the face of the page referring to it.

APPENDICES.

APPENDIX A.

TABLES, RULES, AND CALCULATIONS.

I. Relating to Type.

(a) Point Bodies.

(1) Relative Depths of Bodies: Point System and Old British Bodies.

Points.		Points.	
1	. . . . . 12-to-Pica.	11	. . . *g. t.* Small Pica.
$1\frac{1}{2}$	. . . . . 8-to-Pica.	12	. . . . . . Pica.
2	. . . . . 6-to-Pica.	14	. . . . *g. t.* English.
3	4-to-Pica, or Semi-Nonpareil.	16	. . *l. t.* Great Primer.
$3\frac{1}{2}$	. . . . *l. t.* Brilliant.	18	3-line Nonpareil (*g. t.* Great Primer).
4	. . . . *l. t.* Diamond.	20	. . *l. t.* Double Pica.
$4\frac{1}{2}$	. . . . . *l. t.* Pearl.	22	. . *g. t.* Double Pica.
5	. . . . . *l. t.* Ruby.	24	. . . . 2-line Pica.
6	. . . . . Nonpareil.	36	. . . . 3-line Pica.
7	. . . . *l. t.* Minion.	48	. . . . 4-line Pica.
8	. . . . *g. t.* Brevier.	60	. . . . 5-line Pica.
9	. . . . *g. t.* Bourgeois.	72	. . . . 6-line Pica.
10	. . *g. t.* Long Primer.		

Note.—*l. t.* means "less than"; *g. t.* means "greater than."

(2) Relative No. of Lines Occupied by the Same Matter when Set in Types of Different Bodies (Point System).

This is easily ascertained by means of the following formula :—

$$x = \frac{acm}{bn}\ i.e., a \times c \times m \div (b \times n)$$

where x represents the number sought, a the number of lines the matter makes in the first type, the number of lines of which are

known; b the number of points in the body of that type; c the number of points in the body of the type, the number of lines of which it is desired to know; m the measure or length of a line of type of body b; and n the length of a line of type of body c.

Example 1.—An article makes 156 lines when set in 10-point body; what will it make in the same measure in 7-point body?

Here, the measure being the same in each case, m and n can be disregarded; $a = 156$, $b = 10$, $c = 7$. Therefore x (the number required) $= 156 \times 7 \div 10 = 1092 \div 10 = 109 \cdot 2$ or, say, 110 lines. *Ans.*

Example 2.—An article makes 200 lines when set in 9-point body, the measure being 20 ems pica; what will it make in 6-point body, the measure being 15 ems pica?

Here $a = 200$, $b = 9$, $c = 6$, $m = 20$, $n = 15$. Then, by the formula, $x = \frac{acm}{bn}$ or $\frac{200 \times 6 \times 20}{9 \times 15} = \frac{24000}{135} = \frac{1600}{9} = 177 \cdot 7$, or, say, 178 lines. *Ans.*

(3) Relative Areas Occupied by the Same Matter when Set in Types of Different Bodies (Point System).

Here the relations are not those of the number of points to which the various bodies are cast, but they are those of the *squares* of such numbers. The formula therefore is $x = \frac{b^2y}{a^2}$

where x is the area required, a is the number of points in the body of the type in which the matter has been set, b is the number of points in the body of the type in which the matter is to be set, and y is the area occupied by the matter which has been set.

Example.—Matter set in 10-point body (solid) occupies 12 square inches (or 12 pages); how many square inches (or pages of the same size) will it occupy if set in 6-point body (solid)?

Here $a = 10$, $b = 6$, $y = 12$. Then, by the formula,

$x = \frac{b^2y}{a^2} = \frac{6^2 \times 12}{10^2} = \frac{6 \times 6 \times 12}{10 \times 10} = \frac{432}{100} = 4 \cdot 32$ inches (or pages). *Ans.*

Suppose the page of type b is not to be of the same measure and depth as the page of type a, we must take the relative areas of these pages into account, and the formula will then be:—

$$x = \frac{b^2yz}{a^2z^1}$$

where a, b, and y represent the same things as before, but z represents the area (in square inches or pica ems) of the page of type a, and z^1

the area (in the same units—square inches or pica ems) of the page of type b.

Example.—Matter set in 10-point body (solid) occupies 12 pages, each of which measures 20 ems pica by 32 ems pica; how many pages of type measuring 15 ems pica by 24 ems pica will it occupy if set in 6-point body?

Here $a = 10$, $b = 6$, $y = 12$, $z = 20 \times 32$ ems pica (or 640 ems pica), and $z^1 = 15 \times 24$ ems pica (or 360 ems pica).

$$\text{By the formula, } x = \frac{b^2yz}{a^2z^1} \text{ or } \frac{6^2 \times 12 \times 640}{10^2 \times 360}$$

$$= \frac{36 \times 12 \times 640}{100 \times 360} = \frac{276480}{36000} = 7{\cdot}68 \text{ pages. } \textit{Ans.}$$

Example.—Suppose now we have this question to solve: An article set in 10-point body 6-to-pica leaded makes 14 pages, each of which (excluding headline and whites) measures 21 ems pica wide by 30 ems pica deep; how many pages, each 16 pica ems wide by about $25\frac{1}{2}$ ems pica deep, will it make if set in 8-point body 8-to-pica leaded?

This is a much more difficult problem to solve. We first want to know how many lines of 10-point type there will be in the page 30 ems pica deep. Now, there are 12 points in a pica, and therefore 360 points in 30 ems pica. Again, a line of the type occupies a depth of 10 points, and a 6-to-pica lead occupies a depth of 2 points, together they occupy 12 points; that is to say, each line of type and its lead will want 12 points—therefore in 360 points we get $360 \div 12$ lines, or 30 lines.

Then in the page which measures $16 \times 25\frac{1}{2}$ ems pica, the $25\frac{1}{2}$ ems pica are equivalent to 306 points, and each line of the 8-point body and its attendant 8-to-pica lead will occupy $8 + 1\frac{1}{2}$ point $= 9\frac{1}{2}$ points; therefore in 306 points we can get $306 \div 9\frac{1}{2}$ (which is the same as $612 \div 19$) lines of the 8-point body, and its leads, *i.e.*, 32 lines.

Again, every line of the 8-point type will contain $\frac{10}{8}$ of the words that are in a line of the 10-point type, if it be set to the same measure. But the page of the 10-point type has a measure of 21 ems and that of the 8-point type has only a measure of 16 ems. Therefore a line of the 8-point will get in $\frac{10}{8} \times \frac{16}{21}$ of the words in the 10-point line $= \frac{160}{168}$ or $\frac{20}{21}$ of the number of words; or, otherwise expressed, it will take 21 of the shorter lines of the 8-point to get in as much as 20 of the longer lines of the 10-point.

Our problem may now be stated thus: If the matter when set 30 lines to a page in 10-point type occupies 14 pages, how many pages will it occupy if set 32 lines to a page in type 21 lines of which are equal to 20 of the other?

Set down as a compound proportion sum it is as follows:—

$$\left.\begin{matrix} 32 : 30 \\ 20 : 21 \end{matrix}\right\} :: 14 : x$$

$$\text{or } x = \frac{14 \times 30 \times 21}{32 \times 20} = 13\tfrac{25}{32} \text{ pages; or say, 14 pages.} \quad \textit{Ans.}$$

Caution.—In all the above problems, and all similar to them, it is to be assumed that the faces of the types compared are of the same series, *i.e.*, that the breadth of each is of the same proportion to the depth: should the face of the one be more condensed or more expanded than the face of the other the result would vary accordingly. The headlines and whites must be excluded from the area of the pages, because there is an element of constancy in them, and they do not vary in the same proportion as the word-matter.

(4) Comparative Areas Occupied by Types (Point Bodies).

	When 5-point = 1·000.	*When 6-point = 1·000.*	*When 7-point = 1·000.*	*When 8-point = 1·000.*	*When 9-point = 1·000.*
5-point =	1·000	0·694	0·510	0·390	0·310
6-point =	1·440	1·000	0·735	0·562	0·444
7-point =	1·960	1·361	1·000	0·766	0·605
8-point =	2·560	1·777	1·306	1·000	0·790
9-point =	3·240	2·250	1·653	1·266	1·000
10-point =	4·000	2·777	2·041	1·563	1·234
11-point =	4·840	3·360	2·470	1·891	1·494
12-point =	5·760	4·000	2·939	2·250	1·777
14-point =	7·840	5·444	4·000	3·063	2·420
16-point =	10·240	7·111	5·224	4·000	3·160

	When 10-point = 1·000.	*When 11-point = 1·000.*	*When 12-point = 1·000.*	*When 14-point = 1·000.*	*When 16-point = 1·000.*
5-point =	0·250	0·206	0·174	0·127	0·097
6-point =	0·360	0·298	0·250	0·183	0·141
7-point =	0·490	0·405	0·340	0·250	0·191
8-point =	0·640	0·529	0·444	0·326	0·250
9-point =	0·810	0·670	0·562	0·413	0·316
10-point =	1·000	0·826	0·694	0·510	0·391
11-point =	1·210	1·000	0·840	0·617	0·473
12-point =	1·440	1·190	1·000	0·735	0·562
14-point =	1·960	1·620	1·361	1·000	0·766
16-point =	2·560	2·116	1·777	1·306	1·000

The object of the last table is to facilitate calculations such as those on p. 489. Suppose we have to solve the same problem as is there given, *viz.:* Matter in 10-point body (solid) occupies 12 pages; how many pages of the same size will it occupy if set in 6-point body?

Turning to the table we select the column headed "when 10-point = 1·000," and in that column we find that 6-point = 0·360 (*i.e.*, when matter in 10-point occupies 1 [page, square inch, or other unit of area] the same matter in 6-point occupies 0·360 [page, square inch, or other unit of area]). Hence we just multiply 0·360 by 12 and get 4·320 pages (say 4⅓ pages), which is the answer.

The table is useful also in that it enables one at a glance to compare the spaces the same matter will occupy when set in different type. We can see at once that matter set in 11-point (say Small Pica) occupies nearly 2½ times the space it would if set in 7-point (say Minion); and that what is set in 6-point (Nonpareil) will occupy four times the space if it is set in 12-point (Pica).

(b) Old British Bodies.

(5) NUMBER OF EMS TO THE FOOT.

Six-line Pica	12	Pica	72
Five-line Pica	14½	Small Pica	83
Canon (4-line Pica)	18	Long Primer	90
Two-line Double Pica	20¾	Bourgeois	102
Two-line Great Primer	25½	Brevier	111
Two-line English	30½	Minion	122
Two-line Pica	36	Nonpareil	144
Double Pica (2-line S. Pica)	41½	Ruby	166
Paragon (2-line L. Primer)	45	Pearl	180
Great Primer (2-line Bour.)	51	Diamond	207
English	61	Brilliant	238

This table gives average measurements. The types of various founders, when not cast to points, vary as stated at p. 69 of Vol. I.

(6) APPROXIMATE EQUIVALENTS IN EMS (LINEAL)—OLD BRITISH BODIES.

Pica.	Small Pica.	L. Primer.	Bourgeois.	Brevier.	Minion.	Nonpareil.	Ruby.	Pearl.
6	7	7½	8½	9	10	12	13½	15
7	8	8½	10	10½	11½	14	16	17½
8	9	10	11½	12½	13½	16	18½	20
9	10½	11	12½	14	15	18	20½	22½
10	11½	12½	14	15½	17	20	23	25
11	12½	14	15½	17	18½	22	25½	28
12	14	15	17	18½	20½	24	27½	30
13	15	16½	18½	20	22	26	30	33
14	16	17½	20	21½	23½	28	32½	35
15	17½	19	21½	23	25½	30	34½	38
16	18½	20	23	25	27	32	37	40
17	19½	21½	24	26½	28½	34	39½	43
18	21	22½	25½	28	30½	36	41½	45
19	22	24	27	29½	32	38	44	48
20	23	25	28½	31	34	40	46	50
21	24	26½	30	32½	35½	42	48½	53
22	25½	27½	31½	34	37	44	51	55
23	26½	29	32½	35½	39	46	53	58
24	27½	30	34	37	40½	48	55½	60
25	29	31½	35½	38½	42	50	58	63
26	30	32½	37	40	44	52	60	65
27	31	34	38½	42	45½	54	62½	68
28	32½	35	40	43½	47½	56	65	70
29	33½	36½	41	45	49	58	67	73
30	34½	38	42½	46½	50½	60	69½	75

By means of this table we see that 23 ems Small Pica extend to about the same length as 31 ems of Brevier, or 40 of Nonpareil.

(7) Ems and Ens in a Square Inch of Type (Old British Bodies).

	Ems.	Ens.		Ems.	Ens.
Two-line Pica . .	9	18	Bourgeois . . .	72·25	144·5
Double Pica . . .	12	23·9	Brevier	85·56	171·1
Paragon	14	28·1	Minion	103·3	206·6
Great Primer . .	18	36	Nonpareil . . .	144	288
English	25·8	51·6	Ruby	191·5	383
Pica	36	72	Pearl	225	450
Small Pica . . .	47·8	95·6	Diamond . . .	297·5	595·1
Long Primer . .	56·25	112·5	Brilliant	394	788

A square inch of type weighs, roughly, 4 oz. The above table will therefore assist the printer to estimate what weights he should order when wanting sorts; for if he should order 4 oz. of Nonpareil m's or w's, he would get about 144 types; while if he should order 4 oz. of a's, h's, or k's, he would get about 288, and of i's he would get nearly 600. Therefore, if he wants about 140 Nonpareil i's, he should order 1 oz.

(8) Relative Superficial Spaces Occupied by Types (Old British Bodies).

	When Pica = 1·000.	*When Sm. Pica = 1·000.*	*When Lg. Primer = 1·000.*	*When Bourg. = 1·000.*	*When Brevier = 1·000.*
Pica . . .	= 1·000	1·328	1·528	2·027	2·375
Small Pica .	= 0·753	1·000	1·149	1·525	1·788
Long Primer .	= 0·655	0·868	1·000	1·326	1·556
Bourgeois .	= 0·493	0·656	0·754	1·000	1·172
Brevier . .	= 0·421	0·559	0·643	0·852	1·000
Minion . .	= 0·345	0·459	0·528	0·700	0·821
Nonpareil .	= 0·250	0·332	0·382	0·507	0·594
Ruby . .	= 0·188	0·250	0·287	0·381	0·447
Pearl . .	= 0·164	0·217	0·250	0·332	0·389

	When Minion = 1·000.	*When Nonpl. = 1·000.*	*When Ruby = 1·000.*	*When Pearl = 1·000.*
Pica . . .	= 2·895	4·000	5·316	6·112
Small Pica .	= 2·178	3·010	4·000	4·599
Long Primer .	= 1·895	2·618	3·479	4·000
Bourgeois .	= 1·428	1·974	2·623	3·016
Brevier . .	= 1·218	1·683	2·237	2·572
Minion . .	= 1·000	1·382	1·836	2·111
Nonpareil .	= 0·724	1·000	1·329	1·528
Ruby . .	= 0·545	0·751	1·000	1·150
Pearl . .	= 0·474	0·654	0·870	1·000

The foregoing table[1] shows approximately the relative superficial areas of types not cast to point bodies. For instance, if a certain number of Pica ems (or ens) occupy 1,000 square inches, the same number of Small Pica ems (or ens) will occupy 753 square inches, and the same number of Nonpareil ems (or ens) will occupy 250 square inches.

The practical use of the table is for the solution of such problems as the following :—

Problem 1.—A book consists of 500 pages when set in Small Pica solid ; of how many pages will it consist if set in Long Primer, the page remaining the same in size ?

On referring to the table, we find that Long Primer body is ·868 of Small Pica. Therefore by multiplying 500 by ·868, we get the answer required, *viz.*, 434 pages.

Problem 2.—A book set in Small Pica (solid) makes 500 pages, the page of type measuring 30 ems (pica) wide by 40 ems (pica) long. How much will it make in Brevier (solid) when the page measures 20 by 25 ems Pica ?

Here we find by the table that Brevier is ·559 of Small Pica. We accordingly multiply ·559 by 500, and get 279·5, which would be the answer were the pages to be of the same size ; but they are not ; therefore we have to do this proportion sum :—

$$\left.\begin{array}{c}20 \times 25\\ \text{(the size of the}\\ \text{Brevier page)}\end{array}\right\} : \left\{\begin{array}{c}30 \times 40\\ \text{the size of the}\\ \text{Small Pica page)}\end{array}\right\} : : 279{\cdot}5 : x \text{ (the answer required),}$$

and when this is worked out, x is found to be 670·8, which shows that the proposed book will make about 671 pages.

The same problems can be solved by the use of Table 1 and proportion sums ; only we must remember that as it is superficial area we are dealing with, and not mere lineal measure, it is necessary to square the figures showing the ems to the foot. Thus, to work out Problem 1 above by means of Table 1, we take 90 and 83 as the number of ems to the foot of Long Primer and Small Pica respectively, and we then work out this proportion sum :—

$$\left.\begin{array}{c}(90)^2\\ \text{which is}\\ \text{the same as}\\ 90 \times 90\\ \text{or } 8100\end{array}\right\} : \left\{\begin{array}{c}(83)^2\\ \text{which is}\\ \text{the same as}\\ 83 \times 83\\ \text{or } 6889\end{array}\right\} : : 500 : x.$$

For other tables and problems concerning type, see Vol. I., pp. 70-75, 315, 319, 320, and 550-554.

[1] Calculated on the basis of Miller & Richard's bodies,

Weight of Type.

A square inch of type weighs about 4 oz., and 1 em pica weighs about $\frac{1}{140}$ of 1 lb. Therefore to estimate the weight of type in a page of type, take its area in square inches and divide by 4; or (more accurately) its area in pica ems and divide by 140.

Example 1.—What will be about the weight of type in a page of type measuring 5 inches by 4 inches?

The area of the page is $5 \times 4 = 20$ square inches.

The weight of the page is about $20 \div 4 = 5$ lb. *Ans.*

Example 2.—What will be the weight of type in 220 pages, each page of type measuring 21×34 ems pica?

The area of each page is 21×34 ems, or 714 pica ems; that of 220 pages will therefore be $714 \times 220 = 157{,}080$ pica ems. Divide by 140 and the result is the approximate weight of the 220 pages, *viz.*, 1,122 lb. *Ans.*

N.B.—When ordering type required for a job it is necessary to add about 50 per cent. to the weight worked out as above to make sure of having sufficient sorts.

As to ordering sorts see note under Table 7 on p. 493, *ante*.

II. Relating to Leads.

Number of Ems in a lb. of Leads.

Four-to-pica	520 ems.
Six-to-pica	768 ,,
Eight-to-pica	1,056 ,,

The above is an average obtained by weighing leads of various makers (see Vol. I., p. 112). It used to be stated, and is so still by some writers, that the number of ems in 1 lb. of leads is 576 ems of 4-to-pica leads, 864 ems of 6-to-pica leads, and 1,152 ems of 8-to-pica leads.

Problem.—I have 600 lines of Pica set to 35 ems measure to lead with 4-to-pica leads; what weight will this require?

$600 \times 35 = 21{,}000$ (the total number of ems). Divide 21,000 by 520, and the result is $40\frac{2}{5}$, which is the number of lb. the leads will weigh.

N.B.—I should order at least 10 per cent. more to be on the safe side.

For other tables relating to leads, see Vol. I., pp. 119-121.

III. Relating to Paper.

(1) Dimensions of Sheets of Printing Papers.

	Inches.		Inches.
Pott . . .	12½ by 15½	Double Pott . .	15½ by 25
Foolscap . . .	13½ ,, 17	Double Foolscap .	17 ,, 27
Post (Small) . .	15¾ ,, 19½	Double Small Post .	19½ ,, 31½
Crown . . .	15 ,, 20	Double Crown .	20 ,, 30
Large Post . .	16½ ,, 21	Double Large Post .	21 ,, 33
Demy . . .	17½ ,, 22½	Double Demy . .	22½ ,, 35
Medium . . .	18½ ,, 23½	Double Royal . .	25 ,, 40
Royal . . .	20 ,, 25	Double Super Royal	27½ ,, 41
Super Royal . .	20½ ,, 27½	Quad Crown . .	30 ,, 40
Imperial . . .	22 ,, 30	Quad Demy . .	35 ,, 45

For table showing the sizes of the sub-divisions of sheets, see Vol. I., p. 28.

(2) The Superficial Areas of Sheets.

A Sheet of		Square Inches.	A Sheet of		Square Inches.
Pott	contains	193¾	Double Pott	contains	387½
Foolscap	,,	229½	Double Foolscap	,,	459
Post (Small)	,,	307⅛	Double Small Post	,,	614¼
Crown	,,	300	Double Crown	,,	600
Large Post	,,	346½	Double Large Post	,,	693
Demy	,,	393¾	Double Demy	,,	787½
Medium	,,	434¾	Double Royal	,,	869½
Royal	,,	500	Double Super Royal	,,	1,000
Super Royal	,,	563¾	Quad Crown	,,	1,127½
Imperial	,,	660	Quad Demy	,,	1,320

Those who prefer decimals to vulgar fractions (and the decimals are much more convenient) can use them by changing ¾ into ·75, ½ into ·50, ¼ into ·25, and ⅛ into ·125.

(3) RELATIVE AREAS, WEIGHTS, AND PRICES OF PAPERS.

	When F'cap. = 1	*When Crown* = 1	*When Sm. Post* = 1	*When Lge. Post* = 1
Foolscap . . . . =	1·000	0·615	0·747	0·662
Crown . . . . =	1·307	1·000	0·977	0·866
Small Post . . . =	1·338	1·024	1·000	0·886
Large Post . . . =	1·510	1·155	1·128	1·000
Demy . . . . . =	1·716	1·312	1·282	1·135
Medium . . . . =	1·894	1·450	1·416	1·255
Royal . . . . . =	2·178	1·666	1·628	1·443
Super Royal . . . =	2·456	1·890	1·835	1·627

	When Demy = 1	*When Medium* = 1	*When Royal* = 1	*When Spr. Ryl.* = 1
Foolscap . . . . =	0·583	0·528	0·459	0·407
Crown . . . . =	0·762	0·690	0·600	0·532
Small Post. . . . =	0·780	0·706	0·614	0·545
Large Post . . . =	0·880	0·797	0·693	0·615
Demy . . . . . =	1·000	0·906	0·788	0·698
Medium . . . . =	1·104	1·000	0·869	0·771
Royal . . . . . =	1·270	1·150	1·000	0·887
Super Royal . . . =	1·433	1·297	1·128	1·000

Table 3 is to be used for the double sizes in this way: If, having a Crown sheet, we want to know the relation of Double Demy to it, we find the column headed "when Crown = 1," and see that Demy = 1·312; obviously, then, Double Demy = 2·624. If, again, having Double Demy, we want to know the relation of Crown to it, we take the column headed "when Demy = 1," and finding against Crown in that column ·762, we *halve* those figures, getting ·381 as the relative size of Crown to Double Demy.

If we wish to compare Double (or Quad) Crown with Double (or Quad) Demy or Double (or Quad) Royal, we have only to compare Crown and Demy, or Crown and Royal; for it is obvious that Doubles and Quadruples compared with one another have the same ratio as the single sizes. Therefore, given Double Crown, Double Royal is 1·666 time as large (or as heavy).

The object of Table 3 (calculated specially for this work by the editor) is to enable the printer to tell quickly the relative sizes of different sized papers; and it will equally inform him of their relative weights, assuming the papers to be of the same make. Thus, we see that a Royal sheet is more than twice as large as a sheet of Foolscap, and if we have a 15 lb. Crown, and want to know what the weight of a Royal of the same make will be, we multiply 15 by 1·666 and get 25 lb. as the answer; or if we want to know what a Demy would

weigh, we multiply the 15 by 1·312, and get as the answer 19·68 or $19\frac{2}{3}$ lb. = 19 lb. 10 oz.

Again, it is useful to calculate cost. If a ream of Demy costs 10s., what should be paid for a ream of the same paper in Royal and Crown sizes? Here we multiply 10s. by 1·270 and ·762 respectively, and get 12·7s. (= 12s. $8\frac{1}{2}$d.) for Royal, and 7·62s. (= 7s. 8d.) for Crown.

(4) Relative Weights, etc., of Reams of 480, 500, and 516 Sheets.

	When 480 = 1·000	*When* 500 = 1·000	*When* 516 = 1·000
A ream of 480	= 1·000	0·960	0·930
,, 500	= 1·041	1·000	0·968
,, 516	= 1·075	1·032	1·000

(5) Relative Weights of Sheets, 480, 500, and 516 to the Ream.

	Assuming the ream to weigh x
Each sheet of a 480 sheet ream will weigh	·00208 x
,, ,, 500 ,, ,, ,, ...	·00200 x
,, ,, 516 ,, ,, ,, ...	·00194 x

The above five tables relating to paper are useful for solving such problems as these:—

Problem 1.—A ream (516 sheets) of Double Crown weighs 36 lb.; what will a ream (516 sheets) of Double Demy size of the same paper weigh?

Here we proceed according to the following

Rule: Given the weight of one size, to tell the weight of another size: Multiply the weight given by the size in square inches of the paper whose weight is required, and divide by the size in square inches of the paper whose weight is known.

Turning to Table 2 we find the size, in square inches, of Double Crown and Double Demy to be 600 and $787\frac{1}{2}$ respectively. (We could arrive at these figures from Table 1 by multiplying 20 × 30 and $22\frac{1}{2}$ × 35.) We therefore multiply 36 by $787\frac{1}{2}$, which gives 28,350, and divide by 600, and get $47\frac{1}{4}$ (lb.), which is the weight required.

Another way of arriving at the answer is to refer to Table 3. Find the column headed "when Crown = 1," and take the figures in it which are on a line with "Demy," *viz.*, 1·312, and multiply those figures by 36 (the weight in lb. of the Double Crown), when the result will be 47·25, or $47\frac{1}{4}$ lb.

Problem 2.—Suppose in the first problem the ream of Double Crown consisted of 480 sheets, but the ream of Double Demy would contain 516 sheets, what would the Double Demy weigh?

In this case the weight arrived at, as above (47¼ lb.), would be increased in the proportion of 480 : 516; that is, we should have to multiply 47¼ by 516, and divide by 480, and thus find the weight required to be 50⅘ lb.

A quicker way would be to turn to Table 4. Refer to the line "A ream of 516 = ," take the figures in that line standing in the column headed "When 480 = 1·000," *viz.*, 1·075, and multiply these figures by 47¼. We arrive at the same result, *viz.*, 50·8 lb.

Problem 3.—Which is the heavier paper, a Double Crown, of which a 480 sheet ream weighs 30 lb., or a Double Demy, a 516 sheet ream of which weighs 38 lb.?

According to Table 5, the weight of a sheet of the Double Crown will be 30 × ·00208, or ·0624 lb., and that of a sheet of the Double Demy will be 38 × ·00194 = ·0737 lb.; but to compare the *relative* weights of the two papers we must find what a sheet of the Double Crown would weigh in Double Demy size (or, if we prefer it, what a sheet of the Double Demy would weigh in Double Crown size). By Table 3 we see that to find what a sheet of the Double Crown would weigh in Double Demy size, we must multiply the weight of the Double Crown sheet (·0624) by 1·312, which gives us ·0818 as the weight of such a sheet, and this is obviously greater than ·0737, the weight of a sheet of the 38 lb. Double Demy. Therefore, the Double Crown paper is decidedly a heavier made paper than the Double Demy.

To get the answer without the use of the tables we must state a proportion sum, thus:—

$$\left.\begin{array}{c} 20 \times 30 \\ \text{(The dimensions} \\ \text{of Double Crown)} \end{array}\right\} : \left\{\begin{array}{c} 22\tfrac{1}{2} \times 35 \\ \text{(The dimensions} \\ \text{of Double Demy)} \end{array}\right\} :: \tfrac{1}{480} \text{ of } 30 : x$$

and then compare the result of the sum when worked out with $\frac{1}{516}$ of 38.

The proportion sum works out thus:—

$$\frac{22\frac{1}{2} \times 35 \times 30}{20 \times 30 \times 480} = \frac{21}{256}$$

and $\frac{1}{516}$ of 38 is $\frac{19}{258}$.

To compare them accurately, the two fractions $\frac{21}{256}$ and $\frac{19}{258}$ should be reduced to a common denominator, thus:—

$$\tfrac{21}{256} = \tfrac{2709}{16512} \text{ and } \tfrac{19}{258} = \tfrac{2432}{16512}.$$

But on the view it is obvious that $\frac{21}{256}$ is larger than $\frac{19}{258}$, which means that the Double Crown is the heavier made paper.

(6) RELATIVE WEIGHTS OF REAMS OF 480, 500, AND 516 SHEETS.

516	500		480		516	500		480		516	500		480	
LB.	LB.	OZ.	LB.	OZ.	LB.	LB.	OZ.	LB.	OZ.	LB.	LB.	OZ.	LB.	OZ.
9	8	12	8	6	27	26	2	25	2	45	43	9	41	13
10	9	11	9	5	28	27	2	26	0	46	44	9	42	8
11	10	10	10	3	29	28	1	26	15	47	45	9	43	9
12	11	10	11	2	30	29	1	27	14	48	46	8	44	10
13	12	9	12	1	31	30	0	28	10	49	47	8	45	9
14	13	9	13	0	32	31	0	29	12	50	48	8	46	8
15	14	8	13	15	33	32	0	30	9	51	49	7	47	7
16	15	8	14	14	34	33	0	31	10	52	50	6	48	6
17	16	8	15	13	35	33	15	32	9	53	51	5	49	5
18	17	7	16	12	36	34	14	33	8	54	52	4	50	4
19	18	7	17	11	37	35	14	34	6	55	53	4	51	2
20	19	6	18	9	38	36	13	35	6	56	54	4	52	1
21	20	6	19	8	39	37	13	36	4	57	55	3	53	0
22	21	5	20	7	40	38	12	37	3	58	56	3	53	14
23	22	5	21	6	41	39	12	38	1	59	57	2	54	13
24	23	4	22	5	42	40	11	39	0	60	58	2	55	12
25	24	4	23	4	43	41	11	39	15	61	59	1	56	12
26	25	3	24	3	44	42	10	40	14	62	60	0	57	10

(7) TABLE FOR GIVING OUT PAPER.

No. of Copies wanted.	Number of Impressions on Sheet.										
	2	3		4		8		12		16	
	Sheets.	S.	O.	S.	O.	S.	O.	S.	O.	S.	
50	25	17	1	13	2	7	6	5	10	4	14
100	50	34	2	25		13	4	9	8	7	12
150	75	50		38	2	19	2	13	6	10	10
200	100	67	1	50		25		17	4	13	8
250	125	84	2	63	2	32	6	21	2	16	6
300	150	100		75		37	4	25		19	4
400	200	134	2	100		50		34	8	25	
500	250	167	2	125		63	4	42	4	32	2
750	370	250		188	2	94	2	63	6	47	2
1000	500	334	2	250		125		84	8	63	8

The O. shows the overplus copies that will be obtained.

No allowance has been made for waste.

Table No. 7 shows that if I want 750 copies of a label worked 8 on

a sheet, I must give out 94 sheets of paper; and then, if there be no waste, I should get 2 copies beyond the 750.

To allow for waste, I would give out 98 or 100 sheets.

For another table for giving out paper, calculated in quires and sheets (480 sheets to the ream), see Vol. I., p. 357.

(8) Cost of Paper per Hundred.

Price per Ream of 480 Sheets.	7s.		8s.		9s.		10s.		11s.		12s.		13s.		14s.	
Sizes.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
16mo . .	0	1¼	0	1¼	0	1½	0	1¾	0	1¾	0	2	0	2	0	2¼
12mo . .	0	1½	0	1¾	0	2	0	2¼	0	2½	0	2¾	0	2¾	0	3
8vo . .	0	2¼	0	2½	0	3	0	3¼	0	3½	0	4	0	4¼	0	4½
4to . .	0	4½	0	5¼	0	6	0	6½	0	7¼	0	7¾	0	8½	0	9
Third . .	0	6	0	7	0	8	0	8¾	0	9½	0	10½	0	11¼	1	0¼
Half-sheet .	0	9	0	10½	0	11¾	1	1	1	2¼	1	3½	1	5	1	6¼
Sheet . .	1	6	1	9	1	11¼	2	2	2	4½	2	7¼	2	10	3	0½

Price per Ream of 480 Sheets.	15s.		16s.		17s.		18s.		19s.		20s.		21s.		24s.	
Sizes.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
16mo . .	0	2½	0	2¾	0	2¾	0	3	0	3¼	0	3¼	0	3½	0	4
12mo . .	0	3¼	0	3½	0	3¾	0	4	0	4¼	0	4½	0	4½	0	5½
8vo . .	0	5	0	5¼	0	5½	0	6	0	6¼	0	6½	0	7	0	8
4to . .	0	9¾	0	10½	0	11	0	11¾	1	0¼	1	1	1	1½	1	3½
Third . .	1	1	1	2	1	2¾	1	3¾	1	4½	1	5¼	1	6	1	9
Half-sheet .	1	7½	1	9	1	10	1	11½	2	0¾	2	2	2	3¼	2	7
Sheet . .	3	3	3	5½	3	8	3	11	4	1½	4	4	4	6½	5	2½

(9) Cost of Paper per Thousand.

Price per Ream of 480 Sheets.	7s.		8s.		9s.		10s.		11s.		12s.		13s.		14s.	
Sizes.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
16mo .	0	11½	1	1	1	2¾	1	4¼	1	6	1	7½	1	9	1	10¾
12mo .	1	3	1	5½	1	7½	1	9¾	2	0	2	2	2	4	2	6¼
8vo . .	1	10¾	2	2	2	5¼	2	8½	2	11¾	3	3	3	6¼	3	9½
4to . .	3	9½	4	4	4	10½	5	5	5	11½	6	6	7	0½	7	7
Third .	5	1	5	9½	6	6	7	3	7	11½	8	8	9	5	10	2
Hf.-sheet .	7	7	8	8	9	9	10	10	11	11	13	0	14	1	15	2
Sheet .	15	2	17	4	19	6	21	8	23	10	26	0	28	2	30	4

Cost of Paper per Thousand.

Price per Ream of 480 Sheets.	15s.	16s.	17s.	18s.	19s.	20s.	21s.	24s.
Sizes.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
16mo .	2 0½	2 2	2 3½	2 5¼	2 7	2 8½	2 10	3 3
12mo .	2 8½	2 10¾	3 1	3 3	3 5	3 7¼	3 9½	4 4
8vo . .	4 0¾	4 4	4 7¼	4 10½	5 1¾	5 5	5 8½	6 6
4to . .	8 1½	8 3	9 2½	9 9	10 3½	10 10	11 4½	13 0
Third .	10 10	11 7	12 3½	13 0	13 9	14 5½	15 2	17 4
Half-sheet	16 3	17 4	18 5	19 6	20 7	21 8	22 9	26 0
Sheet .	32 6	34 8	36 10	39 0	41 2	43 4	45 6	52 0

(10) No. of Pages in a given No. of Quires.

Quires.		Pages.	Quires.		Pages.	Quires.		Pages.
1	=	96	5	=	480	9	=	864
2	=	192	6	=	576	10	=	960
3	=	288	7	=	672	11	=	1056
4	=	384	8	=	768	12	=	1152

(11) Sizes of Tea and Tobacco Papers.

Tea.		Tobacco.	
For 1 lb. Parcels .	Foolscap	For ½ lb. Parcels .	Crown Folio
,, ½ lb. ,, .	Crown Folio	,, ¼ lb. ,, .	,, 4to
,, ¼ lb. ,, .	Demy 4to	,, 2 oz. ,, .	,, 6to
,, 2 oz. ,, .	Demy 6to	,, 1 oz. ,, .	,, 9no
,, 1 oz. ,, .	Demy 9no	,, ½ oz. ,, .	,, 12mo

(12) Sizes of Envelopes.

	Inches.		Inches.
Queen's, in ½ size . .	3¾ by 2¾	Medium 8vo, in ½ size .	5½ by 4¼
Albert, ,, ,, . .	4¼ ,, 3¼	Foolscap Envelopes .	8¾ ,, 3¾
Note, ,, ,, . .	4¾ ,, 3¾	Post Flat ,, .	10 ,, 4⅛
Note, in three ,, . .	4¾ ,, 2⅝	Draft ,, .	11 ,, 4⅞
Large 8vo (Com'cial) .	5⅜ ,, 3⅛	Large Card ,, .	4¾ ,, 3¼
Ditto, in ½ size . .	5¼ ,, 4¼	Dble. Small Card ,, .	5 ,, 3¾

(13) Sizes of Bristol Boards.

	Inches.		Inches.
Foolscap	12½ by 15¼	Royal	18 by 22½
Demy	14½ ,, 18½	Super Royal . .	18 ,, 25¼
Medium	16½ ,, 21	Imperial . . .	21 ,, 28½

(14) Sizes of Cardboards.

Cardboards, which are so called, are made in the following sizes: Foolscap, Demy, Royal, Super Royal, Imperial, Double Crown, and Double Foolscap. The dimensions of the boards are the same as the sizes of printing papers bearing the same names.

(15) CARDS TO BE CUT FROM A ROYAL BOARD.

Thirds	96	Small	50	Dbl. Small	25	Quad Small	12
Broad	80	Large	32	Dbl. Large	16	Quad Large	8

(16) SIZES OF CARDS.

	Inches.		Inches.
Third Large, or Thirds	$1\frac{1}{2}$ by 3	Small	$2\frac{3}{8}$ by $3\frac{5}{8}$
Extra Third Large	$1\frac{7}{8}$,, 3	Large	3 ,, $4\frac{1}{2}$
Town Size	2 ,, 3	Double Small	$3\frac{5}{8}$,, $4\frac{3}{4}$
Half Small	$1\frac{7}{8}$,, $2\frac{3}{8}$	Double Large	$4\frac{1}{2}$,, $6\frac{1}{8}$
Half Large	$2\frac{1}{4}$,, 3	Quadruple Small	$4\frac{3}{4}$,, $7\frac{1}{4}$
Reduced Small	$2\frac{1}{8}$,, $3\frac{5}{16}$	Quadruple Large	$6\frac{1}{8}$,, 9

Visiting Cards: Ladies', $2\frac{3}{8}$ by $3\frac{5}{8}$; gentlemen's, $1\frac{1}{2}$ by 3 in.

(17) SIZES OF NOTE AND LETTER PAPERS.

Commercial Letter, 4to size, 10 in. by 8 in.; Commercial Letter, 8vo size, 8 in. by 5 in.; Note Paper (post 8vo), 7 in. by $4\frac{3}{8}$ in.; Albert Note, 6 in. by 4 in.; Queen Note, $5\frac{3}{8}$ in. by $3\frac{1}{2}$ in.

For other sizes of writing papers, see Vol. I., p. 34.

IV. RELATING TO MACHINERY.

(1) TO CALCULATE SPEEDS OF SHAFTING.

If the speed of the engine (*i.e.*, the number of revolutions it makes per minute) and the diameter of the pulleys on it and on the shafting which the belt passes over are known, the speed of the shafting can be easily calculated by a proportion sum.

Let x be the unknown speed of the shafting,
a the diameter of the pulley on the shafting,
b the diameter of the pulley on the engine, and
z the speed of the engine,

$$\text{then } a : b :: z : x, \qquad \text{or } x = \frac{bz}{a}.$$

Example 1.—If the engine makes 80 revolutions per minute, and the diameter of the pulley on it is 15 inches, while the diameter of the pulley on the shaft is $13\frac{1}{2}$ inches, what will be the speed of the shafting?

$$\text{Here } a = 13\tfrac{1}{2},\ b = 15,\ z = 80,$$

$$\text{therefore } x = \frac{80 \times 15}{13\frac{1}{2}} = \frac{2400}{27} \text{ or 89 nearly;}$$

i.e., the shafting will revolve nearly 89 times per minute.

In the same way counter-shafting and the speeds of machines can be calculated; for the formula

$$x = \frac{bz}{a}$$

holds good whenever z is the speed of the shaft driving, b the diameter of the pulley on that shaft, a the diameter of the pulley on the shaft driven, and x the (unknown) speed of that shaft.

Example 2.—My counter-shaft runs at a speed of 120 per minute; the pulley on it is 18 inches in diameter; the pulley on my machine is $13\frac{1}{2}$ inches in diameter, and it makes 8 revolutions to each impression; what number of impressions per hour will the machine give?

Here x = the speed per minute of the pulley on the machine,

then (by the formula) $x = \frac{bz}{a}$, *i.e.*, $= \frac{120 \times 18}{13\frac{1}{2}}$

or $\frac{4320}{27} = 160$;

that is, the pulley on the machine will make 160 revolutions per minute. But each impression requires 8 of these revolutions; therefore the number of impressions per minute will be 20; and the number of impressions per hour will be 20×60, or 1,200. *Ans.*

(2) To Calculate the Proper Sizes of Pulleys.

When a new machine is being put down, it is necessary to make calculations as to the size of the pulley on the shaft which is to drive it, in order to get the proper number of impressions per hour from the machine.

If the revolutions required per minute of the pulley on the machine (a) be known, the diameter of that pulley (b) be known, and the revolutions per minute of the shaft which is to drive the machine (c) be known also, the proper diameter of the pulley on the shaft (x) can readily be calculated by the following proportion sum:—

$$c : a :: b : x, \quad \text{or } x = \frac{ab}{c}.$$

Example 3.—I want my machine to run at 1,200 an hour. Its main shaft makes 8 revolutions to an impression, and the pulley thereon is $13\frac{1}{2}$ inches in diameter; my shafting makes 120 revolutions per minute. What must be the diameter of the pulley on the shaft which is to drive the machine?

Here we have first to calculate the number of revolutions the pulley on the machine must make per minute to get 1,200 impressions per hour. Now, 1,200 per hour is 20 a minute, and as each impression requires 8 revolutions of the main shaft of the machine, the pulley thereon (a) must make 20×8, or 160 revolutions per minute.

Then, we have $a = 160$, $b = 13\frac{1}{2}$, $c = 120$, and by the formula,

$$x \text{ (the diameter required)} = \frac{ab}{c} = \frac{160 \times 13\frac{1}{2}}{120}, \text{ or}$$

18 (inches). *Ans.*

The best way to count the number of revolutions of a pulley, shaft, etc., not moving very fast, is to chalk a mark on it, and then count the number of times it appears (in a minute, or to each impression, as the case may be).

APPENDIX B.

THE following are the names and very short descriptions of various printing machines which may be met with in British Book and Jobbing printing offices:—

TREADLE PLATEN MACHINES.

Arab.—A high-class machine of medium size, something between a Minerva and a Gordon. Small duct and single circular plate.

Bremner.—A high-class machine for general use, with table distribution similar to the Gordon.

Colt's Armory Press.—The Universal as made by Colt's Armory Company.

Cropper.—Another name for the Minerva; also a generic name for treadle platen machines.

Cropper-Charlton Jobber.—A Nottingham-made machine of the Golding Jobber type.

Cropperette.—A cheap, light-running machine of the Minerva type.

Eagle.—Similar to the Minerva.

Empire.—A cheap, simply constructed machine introduced from America in 1877. Not now made.

Empress.—A Nottingham-made machine of the Minerva type.

Express.—Of the Minerva class; made at Reddish.

Falcon.—A fast high-class machine fed like a Wharfedale into grippers, and having an automatic delivery at the rear.

Franklin.—Practically the same as the Minerva. Illustrated on p. 18 of Vol. I.

Golding Jobber.—A high-class American machine with single circular plate and small duct; the prototype of that illustrated on p. 586 of Vol. I.

Gordon, Improved.—A high-class machine for general work, with table distribution, stop-platen, and double rolling gear. Illustrated on p. 590 of Vol. I.

Jardine.—Similar to the Minerva.

Koh-i-noor.—A very fast small machine, akin to the Falcon.

Liberty.—One of the earliest treadle platen machines; invented by Degener & Weiler: the bed and platen are hinged together.

Minerva.—The best known treadle platen machine. Invented by Gordon in America, and introduced into England in 1867. Illustrated on pp. 18 and 589 of Vol. I.

Mitre.—A high-class machine for formes up to demy folio, with cylinder ink distribution.

Model.—A cheap, light-running machine for small formes, akin to the Minerva.

Pearl.—A cheap, light-running machine for small formes. It, the Peerless, the Eaglet, and the Cropperette are alike.

Phoenix.—A German machine like the Universal.

Reddish Jobber.—An English-made Golding Jobber. See illustration on p. 586 of Vol. I.

Rock.—A German machine of rather heavy make.

Simplissimus.—A cheap, light-running machine akin to the Model. No longer made.

Sun.—A heavy machine of the Universal type.

Universal.—A high-class American machine for heavy work, with cylinder ink distribution. Invented by Merritt Gally. Illustrated on p. 591 of Vol. I.

Victor.—Of the Minerva class; made in Leicester.

Ordinary Single-side Stop-cylinder Machines.

Anglo-American.—A high-class Wharfedale by Newsum.

Belle Sauvage.—An early machine of the Wharfedale type; made first by Petter & Galpin, and afterwards by Harrild & Sons.

Bremner.—A Wharfedale by Harrild & Sons.

Climax.— „ by Mann & Co.

Defiance.— „ by Elliott & Co.

Elliott.—A superior Defiance.

Fleet.—A Wharfedale by the Bremner Machine Company.

Ingle.—A cheap machine by H. Ingle; also called the City.

Quadrant.—A cheap machine by J. M. Powell & Son. No longer made.

Reliance.—A Wharfedale by Fieldhouse, Crossfield, & Co.

Standard.—A cheap machine by F. Ullmer.

Wharfedale.—The name given to the original stop-cylinder machine, made about 1855 by Wm. Dawson of Otley (which town is in the Wharfedale), David Payne being his foreman. It has been im-

proved from time to time since, and is now made in various grades by Wm. Dawson & Sons, Payne & Sons, J. Kelley & Co., the Bremner Machine Company, Elliott & Co., Fieldhouse, Crossfield & Co., David Payne & Co., Ltd., all of Otley; Furnival & Co. of Reddish; and Joseph Foster & Sons of Preston. A London Wharfedale was made, 1860-1880, in Southwark by Wm. Conisbee & Sons. See illustrations on pp. 19, 595, and 718 of Vol. I.

Wharfedale, Special.—A Wharfedale more strongly built and with cylindrical inking apparatus for fine work. Made by most of the Otley firms above named.

Stop-cylinder Machines with Overhead Feed.

Augsburg.—A German machine made by the Augsburg Engineering Co.

Bremner Art.—Harrild & Sons' high-class machine, with pyramid inking appliances.

British Fine Art.—A high-class machine by David Payne & Co., Ltd., with pyramid inking arrangements and bed travelling on large wheel runners. Illustrated on p. 610 of Vol. I.

Furnival.—A similar machine. Illustrated on p. 723 of Vol. I.

Hoe.—High-class machines slightly varying in detail; made by R. Hoe & Co.

Perceler.—A fast tumbling cylinder machine, with table inking arrangements, brought out by W. Dawson & Sons in 1900.

Two-revolution Machines.

Century, Cottrell, Hoe, Huber, Miehle, Optimus, Scott, Whitlock.—All American machines with various motive gear and taking-off arrangements, but all more or less like those illustrated on pp. 612 and 726 of Vol. I.

Foster.—A Preston-made Miehle.

Furnival.—A machine like the "Miehle," made by Messrs. Furnival & Co. of Reddish. Illustrated on p. 726 of Vol. I.

Koenig & Bauer.—A German machine of a similar kind, but with its own mechanism.

Special Single-side Cylinder Machines.

Butterfield.—A demy folio fast jobbing machine with a stationary type bed and a travelling cylinder. Brought out in America and introduced into England in 1899.

Cox-Duplex.—A machine of American origin, with a stationary bed and a large travelling cylinder. Introduced into England in 1896.

Little Wonder.—A very fast jobbing machine, with rocking type bed and adapted cylinder, made from foolscap folio to crown size and workable by treadle. Invented in 1887 by D. T. Powell.

Main.—One of the first jobbing machines. Invented in 1851 by Thomas Main. It has a "tumbling," constantly moving cylinder. No longer made.

Ulverstonian.—The first small cylinder machine. Invented by Stephen Soulby of Ulverston in 1852. The cylinder travelled over a stationary type bed. Obsolete.

Perfecting Machines.

These are generally known by the names of their makers. They are of three kinds: (1) machines having two large cylinders, like the machine illustrated on pp. 598 and 729 of Vol. I., and made originally by Cowper & Applegath, and afterwards by Dryden & Foord and Middleton & Co., all of London, and now by these two firms, and also by Dawson & Sons and Payne & Sons, of Otley; (2) machines having two smaller cylinders, and called Anglo-French machines (illustrated on p. 600 of Vol. I.), made originally by Napier & Sons and Hopkinson & Cope, and also by French engineers, and now also made by Payne & Sons of Otley; and (3) single-cylinder machines, now seldom made.

APPENDIX C.

TECHNICAL CLASSES AND EXAMINATIONS.

THE City and Guilds of London Institute for the Advancement of Technical Education (whose centre is in Exhibition Road, South Kensington, London) registers classes for instruction in Typography, and causes examinations to be held annually, certificates being awarded to those who are successful. These classes are now held in all the large towns, and information concerning them and the nature of the Examinations will be supplied by the Secretary, Examinations Department. Care is taken that none but skilled persons are registered as teachers of these classes.

The classes usually commence in October or November, and the Examinations are usually held in the following May. These Examinations are in two grades: (1) Ordinary, (2) Honours, corresponding to a two years' course of study. A Preliminary Examination is also held, but no certificates are granted to those who pass it. Candidates who pass in either the Ordinary or Honours grade are arranged in two classes, a first and a second class, and Certificates (First and Second Class) are awarded to successful candidates in each grade. Candidates who obtain a Second-class Certificate in either grade may be re-examined in any subsequent year for a First-class Certificate in the same grade. Candidates who have obtained a prize in either grade, or a First-class Certificate in the Ordinary Grade, will not be re-examined in the same grade.

Prizes consisting of silver and bronze medals are given, provided the merits of the candidates justify the examiners in recommending them.

The fee payable to the Institute for each Examination is one or two shillings. Intending candidates should apply to their School Secretary, or to the Secretary of the nearest Local Committee, or to the special Local Secretary, who will forward their applications, together with their fees, to the Examinations Department of the Institute, Exhibition Road, London. It is only in the case of candidates failing

to make arrangements with the Local Secretary that any application for examination can be considered by the Institute.

The Examinations are held in the various centres. The question papers are sent in sealed envelopes to the custodian appointed to receive them, on, or immediately before, the day of the Examination, and the envelope containing these papers is opened in the presence of the candidates at the time of the Examination. A number is allotted to each candidate, and he is known to the examiner by that number, and not by name. The worked papers are sealed up immediately on the termination of the Examination, and despatched to the Examinations Department of the Institute in London.

Candidates are qualified for the full Technological Certificate of the Institute in Typography who pass the Preliminary Examination as well as the Ordinary and Honours Examinations (written and practical) in that subject.

A programme of the various examinations, price 10d. *net* (postage extra), may be obtained through any bookseller from the publishers, Messrs. Whittaker & Co., Paternoster Square, London.

Syllabus.

With the view of encouraging apprentices to take a complete Course of Instruction in this subject, an Elementary Examination is held preliminary to that in the Ordinary Grade. No certificates are given on the results of the Preliminary Examination, but the list of the names of the candidates who pass is sent to the Centre at which they are examined. Candidates may enter for the Ordinary Grade without having passed the Preliminary Examination, but candidates for Honours are required to have previously passed in the Ordinary Grade.

PRELIMINARY EXAMINATION.

The Preliminary Examination consists of a paper of questions only in three Sections, and compositors select their questions from Sections I. and II.; Press and Machine candidates from Sections I. and III. The examination includes such subjects as the following :—

I. *General.*—Sizes of papers and cards; number of sheets in quires and reams; pressing—hot and cold; rolling—hot and cold, how each is performed; use of signatures; sizes of furniture and chases; simple schemes of imposition; marks used for readers' corrections; technical terms and phrases; locking-up and unlocking formes; definitions of stereotype, electrotype, woodcut and process blocks, etc.

II. *Composing.*—Spelling; punctuation; compounding of words; division of words; elementary arithmetic as applied to casting-up and casting-off; accents and signs; tools in use in the composing department; characters or classes of type faces for book and jobbing work; sizes of type bodies; relation of type bodies; lays of cases for book and jobbing founts; composing; distributing; spacing; leads, etc.

III. *Press and Machine Work.*—Description of various hand presses, platen and cylinder machines in use; how to cover a tympan, cut out a frisket, prepare a platen for making ready, and dress a cylinder; the working condition of rollers; the care of inks, etc.

ORDINARY GRADE.

The examination in the Ordinary Grade consists of a Paper of Questions, and of a practical examination for compositors to be held in a printing office. Candidates who are compositors must pass in both parts of the examination to obtain a certificate.

Practical examinations for machine managers are held when the necessary arrangements can be made.

The fee for compositors (for Written and Practical) is two shillings.

1. Written Examination.—The examination is divided into two parts, for (*a*) compositors and (*b*) pressmen or machine managers. Candidates, according to their occupation, may select their questions from Sections I. and II., or from Sections I. and III.

The questions are founded on such subjects as the following:—

I. *General.*—Papers, machine and hand made; super-calendered and ordinary papers; when to be wetted and when worked dry; the damping down of paper; counting; packing and keeping stock; the harmony of colours—rules for the selection of two, three, and four colours; sizes of jobs; folding, stitching, stabbing, and sewing.

II. *Composing.*—Lays of Greek, Hebrew, and German cases; more difficult imposition schemes than for Preliminary Grade; casting-up value of composition; casting-off manuscript and other copy; method of making margin; the setting of title-pages and other preliminary matter, with notes, appendices, and indices; mechanical quoins and their application; making up into pages; the point system of type bodies; the system of working in companionships; composition of type music; type-founding and component parts of type metal.

The classification of job work; composition of colour work; the use of tint blocks; display work; the selections of types to suit work in hand; how to form curves and circles, rule bending and twisting;

the use of ornament in display; borders; methods employed for underlaying or making-up skeleton formes in printing in colours.

III. *Press and Machine Work.*—The principal working parts of hand press, platen, and single-cylinder machines; making ready jobs and bookwork on same; making register; use of points; the composition and casting of rollers; inks, medium and quick-drying; coloured inks; suitable inks for certain papers; underlaying and overlaying; hard packing system in making ready—when best employed; preparing overlays for woodcuts and process blocks; imposing stereotype plates for press or machine; varieties of mounting blocks in use; printing with bronzes and leaf metals; the cause of slurring on press or machine.

2. Practical Examination (for compositors).—This consists mainly of composition from manuscript or printed copy supplied to the candidate. It is intended to be a test, not so much of mere rapidity in "picking up," as of general intelligence and of ability in setting any kind of matter that may fall in a compositor's way, clean setting and good spacing being important; for instance, a piece of bad manuscript, a simple displayed title-page or job work, a difficult piece of punctuation, a moderately complex table, a mathematical "building" line, or a piece of pedigree matter; classical phrases or proper names, or a foreign paragraph in fairly good handwriting. The practical test takes place at different Centres throughout the country at which the necessary arrangements can be made. The examination is conducted as far as possible under the superintendence of expert assistants, who are required to report to the chief examiners as to the manner in which the candidates have set about the several exercises given to them.

HONOURS GRADE.

Candidates for Honours must have previously passed in the Ordinary Grade, both in the written and practical parts of the examination.

The Examination for Honours consists of a paper of questions only. It includes more difficult questions in either branch of typography, with a knowledge of perfecting and rotary printing machines, and embraces in all their details the art of stereotyping, electrotyping, and the production of letterpress printing process blocks by the line or tint method; modern labour-saving appliances, including composing and distributing machines; power—steam or gas engines; shafting and gearing; estimating for and charging up work; accounts necessary for a printer, and general management.

Certificates are awarded in the Ordinary and Honours Grades. For the full Technological Certificate the candidate is required to qualify as already stated, or otherwise in accordance with the rules.

The following questions were set in 1897 :—

ORDINARY GRADE.

SECTION I.—GENERAL.

1. Write a list of any four writing and four printing papers, commencing with the smallest in each case, and placing the dimensions in inches opposite each kind.

2. What quantity of double demy (allowing for waste and overs) would you give out for 250,000 demy 8vo handbills to be printed in colours ?

3. Write a list of the pages that would appear side by side on the sheets constituting a 20-page "Particulars and Conditions of Sale" = 5 sheets of folio imposed quirewise.

4. State what classes of paper you consider suitable for the best printing of fine half-tone blocks, naming some of the common defects resulting from using unsuitable papers.

5. Describe as fully as you can the operations of sewing and stabbing as applied to pamphlet or magazine work. State which, with your reasons, you consider preferable, apart from the question of cost.

SECTION II.—COMPOSING.

1. If you were composing—say, in pica italic—a receipt or other form in which the spaces to be filled were represented by 8-to-pica brass rules, how would you justify such rules so as to make them "line" properly with the type employed and "lift" intact from the imposing surface ?

2. Draw a rough sketch of the imposition of a half-sheet of 16mo, and indicate the position of heads, backs, and gutters. State fully how you would proceed to make up the furniture of such a forme.

3. Draw a scheme showing how you would impose, to work as a 32-page forme, the following oddments: (*a*) 16 pages, (*b*) 8 pages, (*c*) 4 pages, (*d*) 4 pages.

4. What type would you use for the footnotes of a demy 8vo work set in small pica, thick-leaded ? In what order would you use the following reference signs ‡ § † * ? If more than four footnotes on any page, what other signs would you employ ?

5. What is the object in using type-high furniture (or clumps) round a forme from which a stereo mould is to be taken? Name the chief points to be observed in preparing such a forme for the stereotyper.

SECTION III.—PRESS AND MACHINE.

1. If you were ordered to print a forme containing several half-tone illustrations without cutting overlays, how would you proceed with a view to obtain the best possible result under such a condition?
2. What steps would you take to ensure perfect register in printing a forme of bookwork at machine that must be worked on rough-edged paper?
3. Give a list of the working parts of an Albion or a Columbian Press.
4. What advantage is obtained by the adoption of hard in preference to soft packing for the printing on a cylinder machine of the best work from process blocks?
5. If, after working a portion of the necessary copies from such a forme as above, a slur appeared, what would you do to ascertain the cause and remedy same?

HONOURS GRADE.

1. A volume of 500 pages set in pica solid is given out with an instruction to make it 250 only, the page being of same area as before. What type, set solid, must be used to make the reduced quantity?
2. Describe fully the process of electrotyping bookwork, and give a list of the tools and appliances necessary for the starting of a small foundry as an adjunct to a printing office.
3. Supposing that you had a crown 8vo plain type volume to print in quad crown 5,000 copies, with a succession of formes to follow, on a single-cylinder machine, what would be a fair time to allow for each forme of 32 pages from the movable—(*a*) for making ready, and (*b*) for running?
4. With regard to the new process of chromotype printing, by the overlapping of the three primary colours—what are these colours? And name a few of the secondary and tertiary results from the combination of the first and second degrees.
5. Illustrated work is in great demand at present, and especially that by the half-tone process. These blocks require care to produce properly, therefore name some of the points to be observed, both

in making ready, to ensure sharpness, and, in working, to obtain a clean impression. What are the characteristics of a good ink for such blocks?

6. What are the preliminary stages of type-founding? How are the punches cut and the matrices made? What is technically understood by the terms beard, shoulder, back, belly, groove, and feet of a type? Draw an outline of a single letter, and indicate the positions of these points.

7. Give a good average working recipe for three important factors in good printing—(*a*) type metal; (*b*) ink; and (*c*) rollers. Cold weather particularly affects the last two—what steps do you recommend to put them both in workable condition?

8. Nowadays papers are nearly always printed dry. What kinds of paper are usually excepted from this rule, and what classes of inks are most suitable for printing dry papers and for those wetted down?

9. What is a good average size of type to be recommended to a customer for books of (1) demy 8vo; (2) fcap. 8vo; and (3) crown 8vo, if quantity is no consideration? Is leading more advisable for wide or narrow measures? State your reasons in answering this question.

10. Enumerate the chief items coming under the heads of (1) productive, (2) non-productive expenses of composing and machine departments in order to arrive at the difference between cost and selling prices.

The following questions were set in 1898:—

ORDINARY GRADE.

SECTION I.—GENERAL.

1. What is meant by the term "super-calendered paper"? Mention some classes of work for which this is most suitable.

2. How can you tell the difference between a hard-sized and soft-sized paper? What would be the effect on each if both were wetted?

3. Describe shortly the difference between the process of stereotyping and electrotyping. Which of the two methods is to be preferred in producing duplicates of wood engravings? Give your reasons for such preference.

4. Name some of the principal causes of "springiness" in a forme consisting of type and blocks, and give the remedies.

5. Which is the better substance on which to mount stereo plates, wood or metal? Give reasons for your choice.

Section II.—Composing.

1. Draw a plan of the case you would recommend for laying a small fount of jobbing type, say about 15 lb., consisting of capitals, lower case, and figures.

2. A pamphlet consisting of 24 pp. solid long primer has to be reset and reduced to 16 pp. In what type should it be composed, the area of the page remaining the same as before? Show the working out of your answer to this question.

3. Write out a list of the principal accents used in the French language; also those used in German and in Portuguese.

4. A royal 8vo pamphlet is to be set in long primer, double column, thick leaded. State what measure you would adopt in composing this work; give in pica ems the width and depth to which you would make up the pages, also the width of furniture you would use in heads, backs, and gutters, when the forme is imposed.

5. Suppose you have 1,000 lines of long primer, thick leaded, 20 ems wide, to make up into crown 8vo, how many pages will it make? Also how many pages if it were thin leaded? Give the cast up price of each at 6½d. per 1,000 ens.

Section III.—Machine and Press.

1. What are the essential points of a good roller for high-class half-tone work? Also for working a forme in red ink?

2. Describe the setting and management of the ink duct when working an eight-page forme of which the four odd pages consist of heavy cuts, and the four even pages of a few lines of light descriptive text.

3. What remedy would you advise for getting rid of the speckled or mottled appearance of the solids when printing in inks of brilliant colours?

4. Describe the difference in making ready a double-crown poster and the same size sheet of fine bookwork.

5. Describe in detail the principle by which the power is applied in a Columbian press and an Albion press respectively.

HONOURS GRADE.

1. A printer receives an order for 20,000,000 crown octavo bills, for which a paper equal to 28 lb. double crown at 2½d. per lb. has been selected. He decides to have a paper made to suit a special machine

that will print 45 bills at each impression. State what would be the size in inches, weight, and cost of the paper per ream, and how many reams (500's) would be required to produce the order. How many "overs" per ream would you give out?

2. Give a complete detailed estimate of the cost of production of above, with the price per 1,000 you would propose to charge for same.

3. Every coloured ink and tint can be produced by the proper combination of some of the following: yellow, red, blue, black, white. What combinations would you employ to produce green, pink, violet, deep blue?

4. Enumerate as far as you are able the parts of a Middleton perfecting machine, describing their use and effect in working, and draw a rough sketch showing the traverse of the sheet from the feedboard to the delivery.

5. What weight of 4-to-pica leads would be required to lead out a work consisting of 6,990 lines set to 20 ems pica in width? Supposing the type to be long primer, and an order given to make up into pages 35 ems pica deep, exclusive of head and white lines, how many pages would the work make?

6. If you had to ascertain the cost of running a number of printing machines, and fix the rate per hour to be charged for work done on each of such machines, what items of expense would it be necessary for you to include in your calculations? Give complete example.

7. What is known as the three-colour process (or chromatic printing) has come to the front during recent years. If left free to deal with an order requiring such work—the *sine quâ non* being the very best results obtainable—what instructions would you give (1) as to working from electros or originals, (2) as to the preparation of plates for machine, (3) as to the class of machine on which to print, (4) as to value of inks to be used? Supposing the number to be printed was so large that you could not do without duplicate electros, what special instructions (if any) would you give as to their production?

8. Give the sizes in inches of the following printing papers: demy, double foolscap, royal, super royal, double crown, imperial. Assuming all to be of the same make and quality, and the demy to weigh 24 lb. per ream, what would be the respective weights of the others?

9. Draw an imposition scheme for 48 pages to work and turn in one forme, and arranged for cutting up and folding as four half-sheets of 12mo without offcuts, all four signatures to appear on the same half of the sheet.

10. If you were charging up the work of an office in which were

printed newspapers, books, magazines, and general jobbing, what percentage on the cost of composition would you allow for reading?

The following were the questions set in 1899:—

PRELIMINARY EXAMINATION.

Compositors are to select their questions from Sections I. and II., and press or machine candidates from Sections I. and III. only.

SECTION I.—GENERAL.

1. Give the size of a double-large card, and state how many of these can be cut from a sheet of royal without waste.

2. What is the object of pressing paper after it has been printed? Describe the operation.

3. What is meant by the terms *quarto* and *octavo?* How many sheets of demy quarto can be cut from a quire of double demy?

4. Name some of the principal causes for spaces and quads rising whilst a forme is being worked.

5. In a sheet of 16 pages, which pages comprise the inner forme?

SECTION II.—COMPOSING.

1. Draw a plan of imposition for three pages of 4to to be printed on first and second pages and endorse. Indicate on the plan what position the endorse would occupy if set for folding to one-third page size.

2. If obliged to do so, how would you divide the words *gelatine*, *preliminary*, *horizontal*, *crucible*, *manipulation?*

3. Describe the difference between roman type, clarendon, and sanserif.

4. A reader has to mark the word "Colonel" to be set in small caps, with a capital C, and "Wingate" to be set wholly in capitals. How would he indicate this on the margin of a proof?

5. Rewrite the following extract, punctuate it, and correct the errors in spelling: "Even the errend boy himself impressed with the sereousness of the situation was convinsed of the nearness of tragidy and was busyly setting fourth to those arround him what he had scene."

SECTION III.—MACHINE AND PRESS.

1. What is the purpose of underlaying a forme? State what defects are thereby remedied.

2. If the platen of an Albion press were not mounted perfectly parallel with the coffin or bed, what would be the result when pulling an impression from a forme?

3. What is meant by a single-side machine? Give a description of one with which you are familiar.

4. Describe the treatment necessary for preserving ordinary composition rollers in good condition.

5. How would you prepare the platen of a "cropper" or small treadle platen machine for working off an ordinary 8vo circular?

ORDINARY GRADE.

Section I.—General.

1. Describe the difference between wove and laid writing paper. In what essential point do they both differ from ordinary printing paper?

2. If a ream of double crown weighs 40 lb., what would be the weights respectively of a ream of double demy and a ream of double foolscap of the same quality and substance?

3. In a display circular printed on white paper in three colours, one of which must be a dark green, what other colours would you propose to harmonise effectively with it?

4. What should be the approximate inside measurements of demy, double crown, and double royal chases?

5. Draw a plan of imposition for a sheet of 12mo (24 pages), with the eight inside pages to fold as an off-cut.

Section II.—Composing.

1. Give the cast-up and cost of composing, at 6½d. per 1,000 ens, of a sheet of 16 pages long primer, the pages being 22 picas wide and 36 picas deep, including white lines.

2. If the above job were leaded with 8-to-pica leads, what weight of leads would be used, assuming that 24 4-to-pica leads of the same length weigh 1 lb.?

3. Describe the operation of composing and proofing a double crown poster in two colours.

4. Describe roughly how you would ascertain the number of pages of long primer that are contained in 200 sheets of manuscript, supposing it were set 22 picas wide and 36 picas deep.

5. A table containing nine columns of subscriptions, each consisting of pounds, shillings, pence, and farthings up to and including £100,

with single rule between the columns and down each side of the whole, must not exceed a width of 37 picas. What is the largest type you can use for this purpose, leaving at least an en quad between the rules and the figures nearest to them?

SECTION III.—MACHINE AND PRESS.

1. Describe the difference in principle between a flat bed and a rotary printing machine. State for what class of work each is best suited.
2. Describe the difference between a fine grain half-tone block and a wood engraving. State how you would treat each in making ready.
3. When printing a job in gold, red, and blue, with key forme in black, which forme would you print first? Give your reasons for this.
4. Describe the operation of making ready a sheet of illustrated bookwork on a perfecting machine, from the time the forme is received from the composing department.
5. What class of ink would you use for printing posters, consisting principally of heavy blocks? Also what kind would you use for fine wood engravings? Give your reasons for each.

HONOURS GRADE.

1. If the composition of 16 pages of solid pica costs £1 4s., how much respectively would the same number of pages, set to the same dimensions, cost in long primer and small pica?
2. Describe any process with which you are acquainted for mounting and imposing stereo and electro plates for machine. State which you consider the best, with your reasons.
3. Write a concise description of the process of electrotyping, from the time a forme leaves the composing department to the delivery of the complete plate.
4. What weight of 8-to-pica leads would be necessary to lead out 500 pages of long primer set 19 ems pica wide, each page containing 37 lines?
5. Describe fully the construction of any two-revolution machine or an ordinary Wharfedale.
6. State what you know of the manufacture of "line" and "half-tone" process plates. Name the chief essentials to a good result.
7. Suppose the manuscript for a pamphlet to contain 18,263 words, and that it has been ordered to be set up in small pica solid, 21 ems pica wide, each line of type averaging seven words. How many

pages, 36 ems pica deep, will it make, exclusive of head and white lines?

8. Make out an estimate in detail of the *cost* of producing complete 10,000 copies of above in cheap pamphlet form, including a wrapper printed on one page only. Reckon the paper for the body of work as equal to 30 lb. double crown at 3½d. per lb., and include in the estimate for composition the setting of head and white lines.

9. Draw an imposition scheme for a forme of 64 pages, to work and turn on a single-cylinder machine, and fold up as four sixteens. Indicate "heads," "tails," "backs," and "gutters," and show how you would proceed to obtain the correct furniture throughout the forme.

10. Draw a rough sketch of the following wording for a large post quarto displayed circular, to be printed in two colours:—
"*Printers' Pension and Almshouse Corporation. A Grand Bohemian Concert will be given at the Royal Albert Hall, Kensington, on Tuesday, March* 4, 1899, *at* 8.0 *p.m., under the presidency of the Chairman of the Council. Many well-known artistes have promised their assistance, and the whole of the proceeds will be handed to the Treasurer of the above Institution. Tickets* 10s. 6d. *each. Carriages at* 10.30."
Assuming it to be ordered for printing on a light green paper, state what coloured inks you would use, and indicate the lines that would appear in the respective inks chosen.

The following are the questions which were set in 1900:—

PRELIMINARY EXAMINATION.

Compositors to select their questions from Sections I. and II., and press or machine candidates from Sections I. and III. only. Mistakes in spelling and punctuation detract from the number of marks awarded.

SECTION I.—GENERAL.

1. Give the size in inches of a demy 12mo, a large post 8vo, and a crown 4to.

2. How many copies of a four-page 8vo circular can be produced from a ream of large post?

3. What is meant by the term "off its feet," and how would you remedy the defect?

4. What purpose is served by the use of signatures in sheets of bookwork, and what positions on the sheets do they usually occupy?

5. Describe the operation of locking up a forme properly, say, a 4to circular.

Section II.—Composing.

1. Explain the difference between the ordinary figures of a fount and split fractions. Show how these latter are used.

2. Describe the operation of spacing the words and justifying the lines in ordinary solid composition.

3. If obliged to do so, how would you divide the following words: *consonant, permissible, decipher, punctuate, language, composition ?*

4. Rewrite, correct the spelling, and punctuate the following extract: "Three or more words frases or clawses in the same construcsion each to be understood seperately and with or without a conjonction befor the last of the sereis are seperated by comas but when the members of the sereis are closely conected in sense the comas should be omited."

5. Draw a plan of imposition of four pages ordinary 4to, and indicate the position of the heads of each page.

Section III.—Press and Machine.

1. Describe the preparation and making ready of a forme on a small platen machine from the time of receiving the same from the compositor.

2. Describe the difference between any platen machine and any cylinder machine with which you are acquainted.

3. State how you would proceed to get the lay and register of a four-page forme on any cylinder machine.

4. How would you clean a forme of type after it has been worked, before returning it to the composing department? What preparation is most suitable for this purpose, and most readily removes the ink?

5. How would you put a new tympan (back and front) on a hand press? And state what material you would use for the purpose.

ORDINARY GRADE.

Compositors to answer the questions in Sections I. and II.; press or machine men the questions in Sections I. and III.

Section I.—General.

1. What is meant by a "coated" paper? How would you detect whether it is coated or not?

2. Some papers give a better result if damped before being printed. Mention a particular kind of paper that damping would suit; also mention some papers that must not be damped.

3. State what you know of the process of producing a stereo from the time the forme is given to the stereotyper.

4. If you had to impose a forme of eight labels, each to be printed in three colours, how would you proceed in order to ensure register?

5. Draw a plan of imposition of 24 pages, consisting of three oddments of eight pages each, imposed in one chase.

SECTION II.—COMPOSING.

1. A certain amount of matter set in pica makes 120 lines 22 ems wide: how many lines would it make of the same measure if set in long primer of a similar series?

2. A job consisting of 128 pages of solid brevier has to be thin leaded: how many more pages will it make, the length of page remaining the same?

3. State what you know of the "point" system, and what advantages are to be derived from the use of it.

4. Describe the operation of making up into page, imposing, and sending to press of a forme of 16 pages.

5. Set out in lines the following wording, displayed as a demy 8vo title page, and indicate the approximate size of type to be used for each line: "Experiences of an amateur printer; his successes and failures." To which is added a glossary of technical terms. By A. Hopewell, Corresponding Member of the Royal Typographical Society. London: W. Caxton & Co., Paternoster Row, E.C., 1900.

SECTION III.—MACHINE AND PRESS.

1. Describe the method of preparing overlays for printing from a wood engraving and from a half-tone process block.

2. What kind of paper is best suited for printing half-tone illustrations? State the reasons for your choice.

3. Describe the principal points of difference between a perfecting machine and a Wharfedale.

4. What colours would you use in making a French grey, a buff, and a lilac?

5. Mention some causes of creasing when working a large sheet on a Wharfedale machine, and state how you would provide a remedy.

HONOURS GRADE.

1. Make out an estimate for the cost of producing a pamphlet royal 8vo, 32 pages, and cover printed on front page only. To be set in long primer, thick leaded, 24 picas wide by 44 picas deep, illustrated

with 24 small engravings inserted in the text, with type run round each. Blocks supplied by customer. Paper at 4½d. per lb. to be used for this, equal in weight to 50 lb. double demy. Cost wanted in detail for composing, machining, folding, and stitching (2 wires) 5,000 copies, and per 1,000 after.

2. Having due regard for economy combined with quality of work, which is the better method, electro or stereo, for reproducing a tabular forme intended for 50,000 runs on ordinary printing paper? Describe in detail the method of reproduction to which you give the preference.

3. Write out in detail your idea of an estimate form for printing office requirements. Also a work ticket to be given out with each job. This latter must show an accurate account of the cost of working.

4. Describe concisely the advantages possessed by a well-ordered and systematically arranged printing office over one of an equal size not properly organised.

5. Name some of the principal sources of waste in time and material in either composing or machine department. State what steps you would take to prevent the waste.

6. In estimating for ordinary machine work, in addition to the labour and ink required, what percentage would you allow for (*a*) cost of machine; (*b*) motive power; (*c*) oil and turps; (*d*) washing up.

7. Describe approximately the composition of type-metal; and state what are the essential qualities (such as alignment, quality of metal, and any other quality you can think of) to be desired in a fount of type.

8. State what description of paper, with weight per ream and price per lb., you would advise for the following jobs: (1) a share certificate; (2) a first-class illustrated circular, 8 in. by 10 in.; and (3) a 40 by 30 poster.

9. Describe as fully as possible the method of reproducing a pen-and-ink sketch by ordinary zinco process, and also of producing a half-tone block from an ordinary photograph.

10. What are the usual qualifications required for (1) an expert machine minder, (2) a thoroughly efficient compositor, and (3) a competent warehouseman?

11. Give a description of the most modern development of the composing machine with which you are acquainted, together with a reasoned opinion of the advantages or disadvantages attending the use of such machine.

INDEX TO VOL. II.

Vol. I. is separately indexed.]

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PRACTICAL PRINTING.

In Vol. II., p. 496, cancel all after Double Demy in the second column of the Table of the Superficial Areas of Sheets and substitute the following:

Double Medium	contains	869½	square inches.
Double Royal	,,	1,000	,,
Double Super Royal	,,	1,127½	,,
Quad Crown	,,	1,200	,,
Quad Demy	,,	1,575	,,